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PROGRAM 437: THE AIR FORCE's FIRST ANTISATELLITE SYSTEM

AIR FORCE SPACE COMMAND
OFFICE OF HISTORY
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by

Dr. Wayne R. Austerman

Air Force Space Command
Office of History
April 1991

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FOREWORD

(U) This monograph was published following Dr Austerman's departure from the AFSPACECOM History Office. Some editing of the original manuscript has been accomplished, but it has not been altered in any fundamental way.

Robert M. Kipp
ROBERT M. KIPP
Chief, Office of History
HQ AFSPACECOM/HO

PREFACE

(U) This monograph documents the background, development, test, deployment, and operation of the USAF's first operational antisatellite system, Program 437, from its origin in the weeks following Sputnik in 1957 to its retirement in 1975. Essentially cobbed together from a variety of existing technologies, it was valuable more as a political response to a future threat than as a war fighting weapon system. Still, from it the Air Force gained valuable expertise in operating a space weapon. The tactical unit which operated Program 437 remained for years the first and only "blue suit" organization in the space launch business.

(U) This study was prepared in large part from documents in the AFSPACECOM and Air Force System's Space Systems Division history archives. From their personal involvement in the program the following individuals provided valuable insight: Colonel T. G. Alcorn (USAF, Ret), Colonel J. R. Barnard (USAF, Ret), Lieutenant Colonel Dennis Eagan, Colonel P. R. Jackson (USAF, Ret), Colonel R. B. Peterson (USAF, Ret), CMSgt A. J. Stotler (USAF, Ret), and Colonel J. W. Yocum (USAF, Ret).

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CHRONOLOGY

04 Oct 57	(U) USSR launched the first artificial earth satellite, Sputnik. The United States was alarmed by the Soviet triumph and pondered the significance of a potential military threat from space.
03 Nov 57	(U) USSR launched a second earth satellite, an 1120-pound craft carrying a canine passenger. Premier Khrushchev boasted that aircraft had been rendered obsolete as weapons systems.
31 Jan 58	(U) Explorer I, the first American satellite, launched from Cape Canaveral, Florida.
26 Mar 58	(U) President Eisenhower released the report of the President's Science Advisory Committee (PSAC) at a White House press conference. It disparaged military importance of space operations.
18 Aug 58	(U) President Eisenhower endorsed a National Security Council Report which advocated an immediate need for military communications, weather, and reconnaissance satellites.
12 Apr 61	(U) The Soviet Union placed the first man in earth orbit.
18 Aug 61	(U) General Laurence S. Kuter, NORAD commander, publicly declared that recent Soviet space operations had advanced the need for an effective American antisatellite weapon system (ASAT).
09 Feb 62	[redacted] Air Force Systems Command (AFSC) issued Advanced Development Objective 40 (ADO 40), which called for research and development geared toward producing an ASAT system.
28 Jun 62	[redacted] The DOD Director of Defense Research and Engineering challenged the value of the USAF's proposed satellite inspection vehicle, citing lack of intelligence on Soviet orbital bombardment capabilities.
12 Sep 62	[redacted] Preliminary development program for a nuclear-armed ASAT derived from ADO 40 was presented to Secretary of the Air

	Force Zuckert. He was critical of the proposed use of a nuclear warhead, but ordered that a fully documented version of the plan be presented for his review as soon as possible.
08 Feb 63	[redacted] Secretary Zuckert officially designated the proposed ASAT system as Program 437.
20 Mar 63	[redacted] Secretary Zuckert instructed General LeMay, USAF Chief of Staff, to ensure that Program 437 received "top priority" among his service's space projects.
15 Apr 63	(U) Headquarters AFSC issued orders creating the 6595th Test Squadron at Vandenberg AFB, California, to oversee development of Program 437.
01 May 63	[redacted] President Kennedy instructed the Department of Defense to develop an ASAT system "at the earliest practicable time."
27 Jun 63	[redacted] Secretary of Defense Robert S. McNamara reviewed planning for Program 437 and declared that he wanted the capability "to initiate the destruction of a satellite by a telephone call."
15 Nov 63	(U) The 6569th Test Squadron deactivated. The unit was immediately reactivated as the 10th Aerospace Defense Squadron (ADS), a component of the 9th Aerospace Defense Force, commanded by Colonel Charles Minihan.
14 Feb 64	[redacted] A Douglas Aircraft Corporation contractor crew staged the first Program 437 test launching of a Thor booster from Johnston Island in the Pacific.
01 Mar 64	[redacted] Second research and development launch from Johnston Island.
05 Mar 64	[redacted] Air Defense Command (ADC) and Space Systems Division (SSD) of AFSC co-authored an operations plan for Program 437.
19 Apr 64	[redacted] Planned third research and development launch cancelled due to a faulty LOX valve.
21 Apr 64	[redacted] Third research and development launch from Johnston Island.
28 May 64	[redacted] First launch from Johnston Island by Air Force personnel.

21 Nov 68	([redacted]) Fifth Program 437 CTL successful.
22 Mar 69	([redacted]) Turbo-pump failure on one of the alert Thors reduced Program 437 to a C-3 status until 2 April.
08 Sep 69	([redacted]) Headquarters USAF Program Change Decision Z-9-107 directed termination of Program 437 at the end of FY 73.
27 Mar 70	([redacted]) Sixth Program 437 CTL conducted as part of the ADC exercise ARLBERG TERROR 70-7.
04 May 70	([redacted]) Deputy Secretary of Defense Packard directed USAF to phase down Program 437 by the end of that fiscal year.
10 Oct 70	([redacted]) Continental Air Defense Command (CONAD) placed Program 437 on a 30-day recall status.
31 Dec 70	(U) 10 ADG redesignated as the 10 ADS.
19 Aug 72	(U) Hurricane Celeste caused substantial damage to facilities on Johnston Island.
10 Aug 74	([redacted]) USAF Program Management Directive (PMD) 30-0 5002 (1)/1241 F terminated Program 437 as an independent activity and consolidated it under the Thor Missile Launch Support Program.
01 Apr 75	([redacted]) Program 437 officially deactivated.

CHAPTER I

Sputnik and the Reluctant ASAT (U)

(U) On 4 October 1957, the Soviet Union launched a basketball-sized metal sphere into orbit around the Earth, and the United States received the greatest shock to its national psyche since Pearl Harbor. Reaction ranged from open anxiety to unruffled complacency. Democratic Senator Henry M. Jackson of Washington called it "a week of shame and danger," while the New York Times warned that "rockets capable of performing the satellite feat must be assumed capable of delivering atomic and hydrogen bombs many thousands of miles." Yet, Clarence Randall, Presidential Special Assistant for Foreign Affairs, casually dismissed Sputnik as a "silly bauble," while Secretary of Defense Charles Wilson advised, "Nobody is going to drop anything down on you from a satellite while you are asleep, so don't worry about it." In his first post-Sputnik press conference, President Eisenhower declared, "Now, so far as the satellite is concerned, that does not raise my apprehensions one iota."[1]

(U) While attempting to calm public fears by downplaying the Russian achievement, American civilian and military leaders were nevertheless genuinely concerned by what it portended. Two months before, on 26 August, the Soviets had announced their acquisition of a workable intercontinental ballistic missile (ICBM). The SS-6 rocket had a range of 3,500 nautical miles, and with proper basing it could reach all of Europe and the northeastern part of the United States.[2] The Eisenhower administration publicly questioned the truth of the Soviet claim to such a weapon and dismissed it as a crude prototype, while affirming that a corresponding American weapon system was making good progress toward operational deployment. Sputnik I seemed to belie those assurances, while demonstrating that Soviet rocketry had advanced further than most people in the Free World had anticipated. It also made it nearly impossible for the American government to keep its concerns over the Soviet advances confined to internal discussions. What had earlier been regarded as a distant, slightly fantastic area of pure speculation had now become a volatile political issue.[3] On 3 November 1957, the Russians surpassed their first triumph by orbiting Sputnik II, an 1120-pound craft that carried a canine passenger. Premier Nikita Khrushchev crowed that "Now the bomber and the fighter can go into museums," an obvious reference to the military potential of the orbital missions. "Muttnik," as it was immediately dubbed by the American press, seemed to prove that the Soviets were rapidly surpassing the United States in every area of astronautics, and that they were well on the way to manned space flight and space weapon systems.[4]

(U) The Soviet space coups coincided with publication of the secret Gaither Report. Designed to analyze the scope and nature of the growing Soviet military threat, it concluded that within two years a Soviet ICBM strike could destroy two-thirds of the Strategic Air Command's bomber force while it still rested on the runways. The prospect was so frightening that several of President Eisenhower's national security advisers advocated an immediate preemptive strike to forestall Soviet acquisition of such a capability. It was in this tense atmosphere that the United States Army's resident German rocket expert, Dr Wernher von Braun, noted the grim implications of a satellite bombardment system in mid-December testimony before the Senate Preparedness Committee and warned the nation could be in "mortal danger" should the Soviets acquire such a capability.[5]

(U) President Eisenhower was concerned about the Soviet Union's apparent progress, but remained skeptical of any immediate threat. He accepted the view of his scientific advisers, who denigrated the basic concept of orbital weapon systems. Eisenhower did not link satellites to military power per se, and this disassociation manifested itself in his conception of the American space program as a whole. The veteran soldier did not want to see weapons in space. In his 9 October 1957 press conference on Sputnik he had closed his remarks by stressing that "Outer Space shall be used only for peaceful, not military purposes."[6]

(U) This determined idealism had already ensured that the Soviets would orbit the first earth satellite. On 26 May 1953, Eisenhower had endorsed the National Security Council's (NSC) approval of a proposal to launch a satellite during the planned International Geophysical Year of 1957-58. Two conditions were attached to the White House's support of the project: (1) the peaceful purposes of the satellite must be emphasized, and (2) no missile designed for military purposes could be utilized as a launch vehicle for the satellite. Also, research on the satellite program was not to be allowed to interfere with any future Department of Defense (DOD) missile programs. Although the DOD would be tasked with supporting the launching of the satellite, its payload would be totally scientific in nature. Necessity would eventually force a change in the "no military boosters" proviso, but in the spring of 1953 it was judged irrevocable.[7]

(U) Eisenhower's rejection of military hardware handicapped the satellite effort from the start, for it excluded use of such potential boosters as the Air Force's Atlas ICBM or the Army's Jupiter IRBM. While the troubled Vanguard rocket program lurched along as the nation's designated satellite lifter, the Army's rocketry effort forged ahead. In September 1956, a Jupiter C made a successful lift-off, flight, and reentry on the Atlantic Missile Range, demonstrating that a workable launch vehicle already existed. Deputy Secretary of Defense Donald M. Quarles later estimated that the Army could have put a satellite aloft as much as two years ahead of time had it been given free rein. As it was, the Defense Department continued to shun using the Army's booster, and come October 1957, Sputnik roared aloft. Two months later Vanguard exploded and burned on its launching pad as the world watched. Not until January 1958 was the Army allowed to mate its Jupiter with a satellite and send it into orbit. Even then, President Eisenhower rejected the martial-sounding "Top Kick" appellation for the satellite, calling it instead "Explorer I."[8] This method of entering space may have been clumsy and wasteful of both time and treasure, but it largely preserved the national ideal of a cosmos untainted by weapons. Having resisted any military connection with the satellite effort until forced to do so by the press of events, Eisenhower and

his advisors also sought to minimize its potential when agitation beg
defined military mission in space.[9]

(U) Suspicious of what he saw as the military's endless appetite for new systems and missions, Eisenhower relied upon the strategic and technological acumen of his civilian counselors. Chief among them on space-related matters was the President's Science Advisory Committee (PSAC). Founded during the Truman years, PSAC acquired new influence and importance after Sputnik. Dr James R. Killian, Jr., PSAC Chairman, was also named First Special Assistant for Science and Technology on Eisenhower's staff. Aside from their advisory role to the President, Killian and PSAC members also influenced a number of important organizational changes: the transformation of the National Advisory Committee on Aeronautics (NACA) into the National Aeronautics and Space Administration (NASA); the creation of a high-level position of Director of Defense Research and Engineering (DDR&E) in the Office of the Secretary of Defense (OSD), and the creation of the Advanced Research Projects Agency (ARPA) in the same office.[10]

(U) PSAC and President Eisenhower's attitudes toward space as a theater of military operations were expressed during a press conference on 26 March 1958, when Eisenhower released a committee document "Introduction to Outer Space" in an attempt to "clear up some of the current fears and fantasies that Sputnik had engendered." In discussing the potential use of satellites as orbital bomb carriers, the PSAC paper dismissed them as "clumsy and ineffective ways of doing a job." Although this analysis overlooked the obvious military value of communications and reconnaissance satellites, it did effectively reaffirm the administration's desire to avoid extending the arms race into a new arena of costly competition between the two superpowers. PSAC members believed that they had a duty to "ridicule the occasional wild-blue-yonder proposals by a few Air Force officers for the exploitation of space for military purposes." Given the prevailing attitudes in the White House, it was not surprising that the earliest attempts to field an antisatellite system met with no success.[11]

(U) The Air Force took an understandably more aggressive view of space. As early as January 1948, General Hoyt S. Vandenberg, Vice Chief of Staff, issued a policy statement that staked out his service's claim to responsibility for developing an earth satellite and to "determine the military worth of the vehicle." Although the Air Force had no formally sanctioned space program for the next decade, it anticipated dominating such an effort. Air Force space policy at the time of Sputnik was rooted in four main assumptions: (1) a mushrooming space technology was required to support such a program, and that in turn demanded extensive research and development efforts; (2) since it claimed everything above the earth's surface was its operational medium, the Air Force would enjoy an inherent right to exercise the dominant role in space operations; (3) for the sake of clarity in strategic planning, it was vital to define the Air Force mission in space operations; and (4) space would become increasingly more critical for the military security of the United States.[12] Although the Eisenhower Administration seemed not inclined to permit development of a military space program of any appreciable size, the Air

Force realized that it must keep its options open and well-defined, for future administrations might not share current attitudes. In the meantime, it faced continuing frustration in attempting to expand its role in the infant space program; and challenges from the Army, whose Ballistic Missile Agency wanted full control of the national space effort on the strength of its successful rocket booster program, and the Navy, who also sought a larger role in space.[13]

(U) Some of the turmoil abated on 7 February 1958 when Neil McElroy, the new Secretary of Defense, established the Advanced Research Projects Agency (ARPA). Created over the protests of the Joint Chiefs of Staff and the House Armed Services Committee, ARPA was intended to quash interservice rivalries by taking control of DOD's proposed space programs. McElroy gave its chief, Roy W. Johnson, broad powers to function above the level of the competing service chiefs. He would manage the advanced scientific projects through their research and development phases. ARPA utilized the individual services' technical and procurement offices for spending, but possessed its own budget and negotiated directly with contractors when necessary. By 1 May all DOD space projects were under its control, and by late June it had assumed responsibility for all Air Force and Army ballistic missile defense projects, with the exceptions of Nike-Zeus and the Ballistic Missile Early Warning System (BMEWS).[14]

(U) While the DOD was moving to organize better its space efforts, President Eisenhower remained ambivalent about the American space program's future course. While he opposed creation of a Department of Space, fearing it would assign priority to satellites, he wanted emphasis placed on the existing military missile programs as necessary tools of deterrence. Although Eisenhower desired to keep the existing space program from being militarized, at the same time he wanted to "put talent, etc, into crash programs outside the Defense establishment."[15] Public and governmental pressure for a major independent space organization continued to mount, and in an early February 1958 cabinet meeting Vice President Richard Nixon warned Eisenhower that demands for it would only increase. The space program had to feature a strong civilian component, and the scientific community would ally with the Democrats in demanding that it be provided. Convinced, Eisenhower sent an April message to Congress requesting creation of a National Aeronautics and Space Administration (NASA). The proposed bill would give NASA control of all space activities, "except those that the President determined were primarily associated with national defense." Thus, on 20 July, when the bill became public law, the American space program was officially partitioned into military and civilian segments. The impetus for an expanded military role increased at once.[16]

(U) On 3 July, the National Security Council submitted a policy statement on outer space to the President. It noted that Soviet superiority in astronautics would be unfavorable to the United States. The NSC stressed the immediate needs for weather, communications, and reconnaissance satellites. "The notion of space systems providing support for operational forces received the beginnings of high level official sanction in this NSC sanction," noted a RAND Corporation study of the evolving space effort. Eisenhower officially endorsed the NSC report on 18 August 1958, and thereby established a dual civilian and military space policy that has endured to the present time. A little more than six years later the Air Force would field a rocket-borne nuclear weapon capable of destroying an orbiting enemy satellite.[17]

(U) Perhaps anticipating progress in the military space sphere, the previous January the OSD had required all three services to list their proposed space projects for its review. The Air Force had cited twenty-six systems or subsystems it deemed essential to national security. Among them was a satellite interceptor. An antisatellite weapons system had been under Air Research and Development Command (ARDC) study as early as 1956, and Soviet advances since then had convinced the Air Force that such a system was needed as soon as possible. ARPA assumed responsibility for the antisatellite (ASAT) study while retaining ARDC as project supervisor. Although the PSAC had earlier discounted the use of satellites as bomb carriers, space weapons theorists like von Braun, former Wehrmacht rocketry expert Major General Walter Dornberger, and Lieutenant General James M. Gavin, forecast the development of a Soviet orbital bombardment capability in the near future. To them the obvious best response would be to acquire an inspection and destruction capability before a Soviet device became operational.[18] From their official statements it seemed the Soviets considered orbital bombs not only viable weapons, but also useful counterweights against American influence overseas. They deliberately linked the issues of nuclear weapons deployment in space to American overseas bases. In response to Eisenhower's proposals on arms control, Premier Nikolai Bulganin declared:

> One cannot fail to see that in raising the question of banning the use of cosmic space for military purposes, the United States is making an attempt, through a ban on the intercontinental ballistic rocket, to ward off a nuclear retaliatory blow through cosmic space while maintaining its numerous military bases on foreign territories intended for attacking the Soviet Union and the peaceful states friendly to it with nuclear weapons.[19]

Bulganin called for "such a solution of the problem as would insure in equal measure the security of the U.S.A., the Soviet Union and all other states. This would be served by such a measure as the banning of the use of cosmic space for military purposes with the simultaneous elimination of foreign bases on the territories of other countries, first and foremost in the territories of Europe, the Middle East and North Africa." This Soviet offer of an empty pledge not to orbit nuclear weapons in exchange for the withdrawal of American forces from all overseas bases was repeated in November 1958 before the United Nations General Assembly when diplomat Valerian Zorin tied the issue to progress on arms control.[20]

(U) In August 1959, the Air Force Ballistic Missile Division (AFBMD) issued a preliminary development plan for a Satellite Intercept and Inspection

System (SAINT). The plan called for development of several different system configurations: unmanned and ground-launched, unmanned and air-launched, and manned. This broad proposal was reduced to one system by the Air Staff due to the high cost of developing multiple systems; and it requested a revised plan to demonstrate the feasibility of a ground-launched, unmanned orbital vehicle featuring rendezvous and inspection capabilities.[21]

(U) The conception of SAINT took place against a broader background of organizational change. That spring Headquarters USAF had assigned the Directorate of Advanced Technology (established in July 1958 under the Deputy Chief of Staff for Development) to coordinate within the Air Staff all USAF space activities, including those in support of ARPA and NASA. In June ARPA recommended a Mercury Task Force to assist NASA in its manned orbital program, and the Secretary of Defense proposed a reassignment of responsibilities among the services for such satellite programs as MIDAS and Sentry.[*] The Army and Navy supported the task force concept and also proposed the creation of a Defense Astronautical Agency to control space systems fielded by the DOD. The Air Force was adamantly opposed on all counts.[22] The service's stubborn adherence to its own goals paid off that September when Secretary McElroy killed both the proposed Mercury Task Force and the Defense Astronautical Agency. He then reversed previous policy and reassigned the military space program from ARPA's control to that of the three services. MIDAS and Sentry reverted to the Air Force, along with Project Discoverer.[**][23]

(U) By February 1960, the Air Staff had carefully reviewed the problems of space defense, and the SAINT program in particular, before forwarding its recommendations to the Secretary of the Air Force. Early in April the Air Force requested approval to construct a prototype SAINT demonstration system as a supplement to ARPA studies funded by the Air Force. By mid-June Dr York had given his consent to a demonstration of engineering feasibility. Work on the prototype SAINT was to be restricted to development, not flight testing, of critical subsystems. Total support of the program would be drawn from Air Force resources.[24] To satisfy York's requirements a revised SAINT plan was offered for official review in July. At that time Undersecretary of the Air Force Joseph Charyk directed that all references to a "kill" capability in the system be excised, restricting the technical effort to inspection capabilities only. This action was in response to the President's "Space for Peace" program. The plan, retitled Satellite Inspection System (but retaining the "SAINT" acronym), went to OSD in July, and received approval a month later.[25]

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[*] (U) MIDAS (Missile Defense Alarm System) and Sentry were, respectively, missile warning and photographic reconnaissance satellite programs conceived in the 1958-59 period.

[**] (U) Project Discoverer was an R&D satellite which performed space research in support of the MIDAS and Sentry programs and for future man-in-space projects.

(U) Although approved, the SAINT program still treaded on uncertain ground. Many saw any move toward deploying even defensive space weapons systems as dangerously provocative. On 11 December 1959, Dr George B. Kistiakowsky, a PSAC member and Dr Killian's successor as the President's Science Advisor, had attended a meeting of the Harvard Law School Forum. The topic of discussion was outer space. One of the participants, George Feldman, delivered an intense, if muddled, speech on the dangers of militarizing space. Feldman, a former chief counsel to the House Select Committee on Outer Space and a subsequent member of the American delegation to the United Nations, advocated the right of peaceful passage for all satellites, but attacked the use of military reconnaissance satellites. In the next breath he emphasized the critical danger the nation faced from Soviet orbital bombardment systems, dismissing Kistiakowsky's rebuttal that such weapons were highly impractical. The thought of critics such as Feldman seizing upon the SAINT program was cause for genuine concern in both the OSD and the Air Force. Highly educated laymen remained ill-informed and anxiety-prone about the prospect of space weaponry, and expert scientists remained disdainful of any potential Soviet space threat and critical of the American military's moves to counter it.[26]

(U) A little more than a month after his discussion at Harvard, Dr Kistiakowsky clashed with Richard Morse, a Special Assistant to the Secretary of the Army for Research and Development. Morse hoped to upstage both the Air Force and the Soviets by modifying the Nike-Zeus ABM system to shoot down satellites from the Army's testing base on Kwajalein Island in the Pacific. Kistiakowsky recalled in his memoirs:

> I emphasized my unalterable opposition to the project which he outlined in a memo to me, of shooting down a satellite, because once we had downed our own satellite, and of course made much to-do about it, the Soviets could easily shoot down one of their own over the Soviet territory, accuse us of doing it, and make a big public issue of it, which would then give them an excuse for shooting down our reconnaissance satellites.

Although SAINT had been reduced to an inspection capability only, the whole idea of intercepting foreign satellites for any purpose was still regarded by the White House as carrying unacceptable risks.[27]

(U) The issue unexpectedly arose again on 3 February 1960, when the White House learned of the appearance of an unidentified, but presumably Soviet, satellite in Earth orbit. When Kistiakowsky was queried on the matter of official policy toward "enemy" satellites, he admitted there was none as yet. Two days later he met with Gordon Gray, Special Assistant to the President for Security Affairs, to prepare for that day's National Security Council meeting and the anticipated discussion of the mystery satellite. Kistiakowsky cautioned that no provocative threats about destroying satellites which overflew American territory should be voiced, lest they give the Soviets an excuse to interfere with American reconnaissance satellite operations. During the subsequent NSC meeting Undersecretary Charyk introduced the Air Force's plans for a satellite interceptor (presumably SAINT) and emphasized that it was designed purely to intercept and inspect, and not to destroy. Kistiakowsky again voiced his opposition to the development of any sort of satellite-killer, and President Eisenhower supported him. Given such resistance at the highest levels of the government, it seemed entirely possible that SAINT might never advance beyond the planning stage.[28]

(U) While the administration remained reluctant to field such a system, the Soviet's continued to develop an orbital weapon carrier. By January 1960, Premier Nikita Khrushchev was boasting to the Supreme Soviet that he had "in the hatching stage . . . a fantastic weapon." By that point the Soviets had confronted two major technical problems which required solution before a workable orbital bombardment system could be deployed: first, the satellite must be made to deorbit and reenter the atmosphere, and secondly, a large warhead must be developed and tested for use in the system, since an orbital weapon was inherently less accurate than an ICBM, and required a more powerful warhead to assure the target's destruction.[29] The successful recovery of Sputnik V, a Vostok-class deorbital satellite, in August 1960 seemed to solve the problem of warhead reentry. The massive space capsule could just as easily have been brought down in North America as in the USSR, and bearing a lethal payload as well. Soviet physicists were hard at work on the task of providing a high-yield warhead for such a system.[30]

(U) Eisenhower and Kistiakowsky realized the implicit potential of Soviet space flights for military purposes, but found themselves severely constrained in their choice of options for countering any future deployments of Soviet military space systems. The highly effective but potentially vulnerable U-2 reconnaissance aircraft was nearing the end of its operational usefulness for such missions over hostile territory, as would be painfully demonstrated in May 1960 when the Soviets brought one down over Sverdlosk. The United States would soon be vitally dependent upon reconnaissance satellites for timely strategic intelligence. It could not afford to give the Soviets any excuses to interfere with those precious assets. Premier Khrushchev would subsequently issue a public warning that American "espionage" satellites could be "paralyzed and rebuffed." The testing and deployment of an American system such as SAINT could conceivably elicit a violent Soviet response against the vulnerable intelligence satellites.[31]

(U) Eisenhower was probably relieved to hand the entire problem over to his young successor in January 1961. John F. Kennedy's election had hinged in part upon his criticism of the Republicans for allegedly permitting the Soviets to seize a lead in the missile race. Once in office, however, the new administration followed a similar course of restraint. Although Kennedy and Secretary of Defense Robert S. McNamara acknowledged the legitimacy of military space concerns, they were reluctant to grant the Air Force a free rein in developing its stable of projects.[32]

(U) Like Eisenhower, Kennedy did not want to be drawn into an expensive and potentially destabilizing race for military supremacy in space. In his inaugural address he called upon the Soviet Union to "let both sides seek to invoke the wonders of science instead of its terrors. Together let us explore the stars, conquer the deserts, eradicate disease." In March 1961, he responded to a Congressional inquiry on the space program's direction by answering, "It is not now nor has it ever been my intention to subordinate the activities of NASA to those of the Department of Defense." Although SAINT remained in active research, and the Air Force Dyna-Soar space bomber program was in development, NASA was to remain the nation's primary space agency, and all military projects would accordingly be kept on a tight rein.[1]

[redacted]) Despite Kennedy's reluctance to see the arms race extended into space, the Air Force continued to covet an effective ASAT capability. That same March the Air Defense Command issued a formal Qualitative Operational Requirement (QOR) for a Satellite Interceptor System (SIS). The document outlined an operational mission for the system that included interception, inspection, and determination if an unknown satellite was hostile. "Upon determination that an unknown satellite is in fact hostile, the neutralization, destruction and/or de-orbiting of same will be accomplished." Whatever form such a system might eventually assume, the Air Defense Command had issued an unequivocal statement of operational necessity for it in that first winter of the Kennedy presidency. Before his tragically brief span in office was completed, the nation would have a less sophisticated but still lethal satellite negation capability.[2]

(U) Whatever his personal desires might be regarding the course of the American military space program, Kennedy was still hostage to the sweep of events, and his thinking about space received sober reassessment in the wake of another stunning Soviet triumph. On 12 April 1961, Major Yuri Gagarin orbited the Earth in Vostok I and safely returned to the Soviet Union. "It was the sputnik crisis all over again except that there was now a space agency," remarked one scholar. The Soviet accomplishment moved Kennedy to assign to NASA a manned lunar landing mission to be carried out before the end of the decade. It also meant the Russians had completely mastered the problem of making an orbital vehicle reenter the atmosphere upon command and impact in a predetermined area. When Vostok II carried Major Gherman Titov into orbit the following August, the Soviets deliberately chose to emphasize the flight's military implications. Both Tass and Krasnaya Zvezda openly linked the Vostoks with a bomb delivery capability. At a celebratory meeting in Moscow, Khrushchev boasted, "We placed Gagarin and Titov in space, and we can replace them with bombs which can be diverted to any place on earth."[3]

(U) By early 1961, Under Secretary of the Air Force Charyk had established a working group to study the total Air Force space program. Simultaneously, planning was underway to consolidate SAINT goals of interception and inspection with the NASA Mercury II (Gemini) program objectives of docking and transfer of astronauts. A tentative proposal for a joint NASA/USAF program was framed, but SAINT continued to develop independently as prescribed in the 1960 plan, with expectations pegged to a first launch in July 1963.[36]

(U) Although the April 1961 creation of Air Force Systems Command (AFSC) and its subordinated Ballistic Systems Division and Space Systems Division expedited progress on such systems as SAINT, a dearth of funding and the new administration's caution prevented the Air Force from moving as quickly as it felt necessary. The proposed SAINT/Gemini merger foundered because of conflicting military and scientific needs. SAINT survived as a program, but controversy erupted over the greater military role in space in the wake of the Vostoks' flights. Ten of Titov's seventeen orbits had taken him over North America, prompting General Laurence S. Kuter, NORAD commander, to state: "This had advanced the era of a requirement for an anti-satellite weapons system which can deal with an armed enemy satellite."[37]

(U) The Kennedy administration found itself under heavy criticism from opponents of its space policy. Robert Hotz, editor of Aviation Week and Space Technology, scored the government in a September 1961 editorial for substituting the "vague and less urgent demands of pure scientific research for the vital urgency required for development of new military weapons." Hotz argued that "if the military role in this program is defined as merely using its already substantial facilities and capability in space technology to support a program limited to civil scientific goals, we shall indeed face serious trouble as the challenge of Soviet military space becomes more apparent and Russian capabilities approach the operational phase." Ten days later Trevor Gardner, a former Assistant Secretary of the Air Force for Research and Development, addressed a meeting of the Air Force Association and pointed out that it was well within the current Soviet capability to begin orbiting nuclear weapons. His criticisms of national space policy were seconded at the meeting by Walter Dornberger and General Bernard Schriever of the Air Force.[38]

(U) Schriever persisted in his public agitation for an expanded military space mission, delivering appeals in counterpoint to the surprise Soviet tests of multi-megaton weapons that September and October. On Columbus Day 1961, he told a meeting of the American Rocket Society that such weapons could easily be orbited by current Soviet launch vehicles and insisted that it was "artificial" to separate peaceful and military research in space.[39] His criticisms stung the administration, and it replied the following evening when Vice President Lyndon B. Johnson addressed the rocket society. "We are developing the peaceful uses of outer space from choice," said Johnson, "but we are working on the military uses of outer space from necessity. The difference is basic, not superficial. And it is permanent and not temporary." Johnson's message was clear. Prudent members of the military would no longer publicly challenge official space policy. "In this manner the curtain rang down . . . with the military silenced and a peaceful expression stamped on the face of the national space program," noted Robert Salkeld in War and Space.[40]

(U) While SAINT limped along in secret development and the Air Defense Command continued to request a satellite interceptor, President Kennedy repeatedly emphasized his desire to keep space demilitarized. In an October address to the United Nations General Assembly, he called for agreements banning nuclear weapons form space. As the new year opened, a growing skepticism of Soviet capabilities took hold within the Defense Department, and the standing policy of downplaying the military space program deepened. In late March 1962, the Air Force requested additional funding to support more test launches for SAINT and a boost to the FY 63 funding for the program. Both requests were rejected, and on 28 June the Director of Defense Research and Engineering officially challenged SAINT's value, citing the lack of hard intelligence on Soviet orbital bombs. The program remained intact, but there was still no sense of a clearly defined need or role for such a system in the DOD's strategic vision.[41]

(U) In September President Kennedy reemphasized the administration's position on the utilization of space in a speech at Rice University, during which he declared that "we have vowed that we shall not see space filled with weapons of mass destruction but with instruments of knowledge and understanding." Deputy Secretary of Defense Roswell Gilpatric commented about the same time that "an arms race in space will not contribute to our security. I can think of no greater stimulus for a Soviet thermonuclear arms effort in space than a United States commitment to such a program. This we will not do." From the public pronouncements made by its spokesmen, it seemed that the Kennedy administration believed that a declaration of national abstention and deemphasis on defensive systems to oppose such weapons would elicit a spirit of reciprocity from the Soviets.[42]

(U) This policy of reliance upon Soviet forbearance received a jolting shock that October as the Cuban Missile Crisis erupted. With Soviet intermediate range ballistic missiles and jet bombers based in Cuba to outflank North America's early warning systems, it seemed entirely possible that the Russians might also opt to loft nuclear weapons into orbit to gain an added edge over the Americans' deterrent forces. Ironically, the first test of an American ASAT occurred, quite unintentionally, that month as the Air Force and the Atomic Energy Commission conducted STARFISH. This high-altitude nuclear weapons test over the Pacific revealed the phenomenon of Electromagnetic Pulse (EMP) effects. The test shot damaged several communications satellites when its massive emission of high energy electrons destroyed their electronic circuitry even though none of them were within a line of sight to the detonation. Although the STARFISH results were kept classified probably as much from embarrassment as from the dictates of national security, the implications for the use of any future nuclear-armed ASAT system were obvious. The Soviets, who conducted a series of three high-altitude, multi-megaton test bursts that October and November, must also have registered similar data on the blasts' effects upon electronic equipment.[43]

(U) Meanwhile, the official Soviet publications discussed the legal and strategic ramifications of ASAT systems. A volume on space law published in 1962 posed a legal case for satellite destruction, arguing that the overflights of foreign reconnaissance spacecraft violated Soviet national sovereignty. In such instances the aggrieved nation had an "indisputable" right to defend its airspace against such intrusions. Another official publication, Military Strategy, painted a picture of aggressive American designs in space, and a subsequent edition of the same volume called for "corresponding means assuring the timely detection of enemy space equipment and its rapid destruction or neutralization." In February 1963, Defense Minister Malinovski announced the formation of a special ASAT division of the PVO-Strany (Air Defense Force), designated as the Protivo Komisecheskaya Oborona (Against Cosmic Attack), which was to be equipped with "special spaceships, satellite fighters and other flying apparatus armed with rockets and radio-electronic apparatus."[44]

(U) Even though the Soviets were pressing for an announced ASAT capability, the American SAINT program continued to call for a demonstration of orbital inspection capability only. No plans for an operational system had yet been approved, but that did not deter the other services from proposing their own pet ASAT projects. The Navy campaigned for a system (called Early Spring) derived from the Polaris submarine-launched ballistic missile program, but it died in the planning stage. The Army placed great hope on an adaptation of its experimental Nike-Zeus ABM system. Called Program 505, it posited a modified missile which could reach out for 1,200 miles to kill satellites at an altitude of 200 miles, with operational deployment of the system possible as early as 1967. In May 1962, Secretary McNamara approved the Nike-Zeus ASAT testing program, and trials began at both White Sands Missile Range, New Mexico, and on Kwajalein Atoll in the Pacific.[45]

(U) As SAINT lurched along toward a dimly seen horizon, Air Force planners examined the need for a successor system with a direct-ascent kill capability. The problem was that there was still confusion in the DOD over the entire ASAT concept. In June, DDR&E's Dr Harold Brown had quashed expansion of the SAINT launch testing program, saying that there was no need for an early system capability for satellite inspection or negation, and reiterating that "this program should proceed only at an orderly pace on a strictly R&D basis."[46] While Brown was calling for restraint, Secretary McNamara was exhorting the Air Force to "get on with the SAINT program," having noted an anticipated Soviet ASAT capability and the resultant need for the United States to be able to warn, "If you shoot down one of ours we will shoot down one of yours." A perplexed Air Force Chief of Staff, General Curtis LeMay, pointed out these inconsistencies to Secretary Zuckert that July, prior to the Cuban Missile Crisis, and asked for a clearer statement of priorities. Aware that Brown had earlier endorsed the Army's ASAT testing program, the Air Force may have hoped to force a comprehensive review of the entire issue.[47]

[redacted] By this time the increasingly problem-plagued SAINT was viewed with declining enthusiasm even by its Air Force patrons. The Air Staff was therefore receptive when AFSC issued Advanced Development Objective 40, "Anti-Satellite

Program," on 9 February 1962 in response to ADC's previously stated need for an ASAT capability. On 12 September, a preliminary plan for the program was forwarded to Secretary Zuckert. He was critical of the system's proposed destruction capability, which depended upon a nuclear warhead mounted atop a Thor IRBM booster launched from Johnston Island in the Pacific Ocean. Air Force Systems Command projected a series of four test launches occurring over the course of a year to make the system operational against satellites at any inclination and altitudes up to 900 nautical miles. An estimated $25 million would be required for development costs and procurement of six operational Thors. Zuckert ordered a fully documented version of the plan be submitted to him as soon as possible.[48]

(U) By mid-December, Zuckert had reviewed the plan. OSD informed him that "some version of your proposal (the Thor ASAT) appears to be the fastest way of obtaining an increased capability on range and altitude beyond that which will be available from the Nike-Zeus installation on Kwajalein (Program 505)." A revised Space Systems Division plan was forwarded to DDR&E's Brown on 6 February 1963, and on 12 April he approved it. The tentative Thor development program was limited to a four-launch feasibility demonstration slated for early 1964. Although Brown initially approved $6 million in FY 63 and $11 million in FY 64 funds for the effort, this sum was subsequently adjusted by OSD to total $16 million from the FY budget only.[49]

(U) By February 1963, Secretary Zuckert had officially designated the effort as "Program 437," and just over a week later, on 15 February, the DOD directed the Air Force to prepare for an "operational standby capability following the intercept demonstration." A new operational concept plan was quickly drafted and submitted to Zuckert, who quickly accepted it. In a memo to the Chief of Staff he remarked:

> I have just reviewed Program 437 and wish to reemphasize the fact that development of an operational capability to negate satellites has top priority among defense programs. Action must be taken, therefore, to insure that the necessary resources are allocated to AFSC to expedite conduct of the research and development demonstrations and the establishment of an emergency operational capability.[50]

(U) Zuckert's new-found enthusiasm for the ASAT system may have been rooted in a change of attitude in the White House about the necessity for such a weapon, for in early May 1963, President Kennedy directed the DOD to develop an ASAT system "at the earliest practicable time." The precise reasons for the administrations's abrupt change of heart on the ASAT issue remain unknown, and there was apparently some lingering reluctance felt by Secretary McNamara even after the White House consented to the fielding of Program 437. Late in 1963, as work proceeded on the project, McNamara attended a meeting that was intended to review the need for (and political sensitivity of) Program 437. Colonel Harry E.

Evans, Chief, Research and Development Division, J-5, was present from the office of the Joint Chiefs of Staff. Also attending were Dr Brown of DDR&E, Under Secretary of State U. Alexis Johnson, and Edward R. Murrow, Director of the U.S. Information Agency.[51]

(U) Secretary McNamara remained concerned with what he felt was the extreme political sensitivity of the nuclear-armed ASAT system. "By that time the JCS had stated a requirement for a military capability to destroy a bomb in orbit, should one be placed there by the Soviets," recalled Colonel (later Major General) Harry L. Evans in 1986. "Most of the civilian leadership of both the State and Defense Departments were very nervous about even having a program of research or development for something like 437, let alone the prospect of having such a system operationally ready and manned by 'blue suiters.' Certainly the aspect of detonating a nuclear weapon in space was politically unattractive to them."[52]

(U) The participants weighed the pros and cons of the system's technical feasibility and political utility at great length, but "after considerable discussion it was apparent that most of those present were against such a political liability," noted Evans. The issue seemed decided until, "at that point, Ed Murrow, heretofore quiet and puffing on his ever-present cigarette, made the following statement (essentially), 'If the Soviets place a bomb in orbit and threaten us and if this administration has refused to develop a capability to destroy it in orbit, you will see the first impeachment proceeding of an American President since Andrew Johnson.'"[53]

(U) At least two minutes passed in total silence following Murrow's warning, and then Secretary McNamara was reported to have testily remarked, "Well, it doesn't cost much, and the JCS want it, so let's approve 437." The context of McNamara's remarks, as related by Evans, indicate that while in concept the program was seen as a political menace by the OSD, there was also tacit agreement that not having it might, under certain circumstances, mean political suicide. That the fate of Program 437 was still being debated at least six months after it was approved by DDR&E, and in the wake of President Kennedy's admonition to the DOD to field an operational ASAT quickly, seemed to indicate the project was still viewed with deep apprehension. The irony was that within a year the same administration would be holding up Program 437 to public view as proof of its prescience in defense matters. By that time, an obscure little spit of coral in the Pacific would have become the home of the Free World's only operational ASAT system and the culmination of an effort that had unfolded with surprising speed and efficiency once the determination had been made to let it proceed.[54]

NOTES

(All Notes are Unclassified)

Chapter I

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CHAPTER II

Program 437 Development and Operational Testing (U)

(U) Cancellation of the troubled SAINT program in December 1962 left Program 437 as the Air Force's only space weapons system. The original Advanced Development Objective (ADO-40), issued by the service in February 1962, had called for the "demonstration of the technical feasibility of developing a non-orbital collision-course satellite interceptor system capable of destroying satellites in an early time period." Although an aircraft-launched system was not excluded from consideration, AFSC realized that speed of development and deployment were the prime considerations in the program; and in its preliminary plan, submitted to Secretary Zuckert in September 1962, it opted to use the proven Thor LV-2D booster as the launch vehicle. Thor was a known quantity and readily available in sufficient numbers following its withdrawal from Europe that year.[1]

[redacted] The operational plan approved by Zuckert called for a dual launch pad complex on Johnston Island to be used for demonstration, training, and operational missions. The missiles and support facilities were to be located at Vandenberg AFB, California. Three missiles were to be ready for airlift to the island if the need arose for a mission. If deployed to the island, two of the boosters would be counted-down simultaneously, thus providing a backup in case the primary missile failed to launch successfully. Anticipated reaction time from the receipt of the alert order to launching was two weeks, although subsequent planning called for a limit of no more than three days for deployment upon receipt of warning.[2]

[redacted] Some internal Air Force argument regarding control of the Program 437 marked the early stages of the project, but ADC was soon designated as the resource manager, and Commander in Chief Continental Air Defense Command received operational control.[3] While the technical concepts and lines of authority were being defined, people and hardware were brought together. Colonel Quentin Riepe, the System Program Director, worked under tight time constraints. Three or four years' normal work had to be compressed into less than eighteen months. As early as 20 March 1963, Secretary Zuckert had directed the USAF Chief of Staff to ensure that Program 437 received "top priority among defense programs" by making certain that AFSC received the necessary resources to expedite research and development demonstrations and to establish an emergency operational capability. Brockway McMillan, the Air Force Assistant Secretary for Research and Development, directed that Program 437 receive a DX priority (in effect a downward-directed Presidential level priority authorization for the acquisition of contractor-supplied materials), and instructed the System Staff Office to "bring problems requiring top level assistance to the attention of the Secretary immediately for resolution." After years of reluctance to field an operational ASAT system, it must now be hurried into operation.[4]

[redacted] On 20 April 1963, Headquarters AFSC created the 6595th Test Squadron at Vandenberg AFB, California. Assigned to the 6595th Aerospace Test Wing, the squadron was authorized 18 officers and 135 airmen for the task of making Program 437 operational. Many SAC veterans of the Thor program were drafted into the new unit, while ADC eventually contributed personnel who had worked on the BOMARC missile program a few years earlier. SAC's 4300th Support Squadron, which had earlier trained Royal Air Force Thor missile crews in its former guise as the 392d Missile Training Squadron, was also dedicated to AFSC for support of the ASAT project. In addition to personnel, SAC was ordered to provide AFSC with the maintenance building and Pad 7 of the Thor launch complex at Vandenberg for Program 437 use. Meanwhile, Dr McMillan had arranged for Bell Telephone Laboratories to help with the missile guidance system. Atomic Energy Commission cooperation was also obtained, and it arranged for the Albuquerque-based Sandia Corporation to help convert the reentry vehicle to an ASAT configuration.[5]

[redacted] Colonel Riepe had the enthusiastic support of his superiors, but he would need every bit of energy and enthusiasm that he could muster to ensure that the program stayed on schedule. Initial planning called for an "austere operational program" carried out by a squadron of 175 men, including three launch crews stationed at Vandenberg AFB, with only a caretaker contingent manning the Johnston Island site. Upon alert notification, two crews and the missile systems would be deployed to the island. Two weeks would be needed from alert to launch. In addition to the procurement of four Thor missiles to support the development and testing phase of the program, another sixteen were to be acquired from stocks returned to the United States from Great Britain following termination of the IRBM basing program in that country. AFSC would organize, man, equip, and train the operational squadron. Based upon receipt of fiscal 1964 funding by July 1963, the schedule called for the first combat readiness launch to occur in April 1964, followed by three more at approximately six week intervals. Initial operational capability was slated for May 1964, with full operational capability the following October. Funding required for the program was estimated at $55 million through Fiscal Year 1967.[6]

[redacted] This schedule was ambitious enough, but time became an even more urgent concern on 27 June when Secretary McNamara reviewed the plans and expressed his unhappiness with the schedule. He called the planned reaction time of two weeks for the operational system unacceptable. McNamara wanted the capability to "initiate destruction of the satellite by a telephone call." Under such conditions total response time would be about four to five hours, but certainly no more than twelve hours, after receipt of the alert order. Although a Defense Research and Engineering representative present at the meeting pointed out that target position computation alone required thirty-six hours of radar tracking before accurate position predictions could be supplied, McNamara was still adamant that response time be reduced to the barest minimum.[7]

[redacted] On 21 August, AFSC published a revised plan for Program 437 Phase II. The new concept called for a squadron to be based at Vandenberg AFB with permanently assigned support personnel. Technical personnel would be sent on temporary duty to Johnston Island on a 90-day rotational cycle to provide a quick reaction time. Total squadron strength was 468 personnel: 79 on the island and 389 at Vandenberg. At any given time, 108 of 389 squadron members based at Vandenberg would be TDY to the island. The squadron's inventory was to consist of six missiles: two operationally ready at Johnston Island and four in back-up status at Vandenberg. The system would be operated by ADC under the control of CONAD. After the initial combat readiness launch, three combat training launches per year were authorized to maintain crew proficiency. Initial operational capability was still planned for May 1964. Equipment included 16 launch vehicles (4 for war reserve stockpiling and 12 for training launches); 21 guidance packages; 19 payload assemblies; and 22 warheads. The need for reduced reaction time increased 437's cost to $57.277 million through Fiscal Year 1967. By the end of 1963 the DOD had approved this operational concept, but reduced the number of boosters to be acquired from 16 to 8.[8]

[redacted] The publication and subsequent DOD approval of the revised plan for the operational system clarified matters considerably for Colonel Riepe's management team. The system consisted of two launch-ready Thors on Johnston Island with full support facilities and equipment. The essential mission training and support facilities would remain at Vandenberg. Target position data would be provided by ADC's Space Detection and Tracking System (SPADATS). The island launch complex and essential support facilities were to be comprised of two launch emplacements with related equipment, including the requisite check-out trailers and vans. Additionally, there would be a ground guidance station, payload command detonation system, launch control center, direction and targeting centers, and support equipment. Mission safety equipment, payload storage facilities, fuel storage, a communications center, and general support facilities were also slated for construction. Considerable work had yet to be undertaken to prepare Johnston Island for Program 437. Although the small island had been the site of earlier nuclear test activities, few facilities remained. Consequently, funds was added to the FY 63 and 64 defense budgets to lengthen the island's existing runway and to enlarge its size by 270 acres of dredged coral.[9]

[redacted] At a 20 September 1963 meeting of the Designated Systems Management Group for the program, Colonel Riepe recommended early release of logistic support funds for the effort, early JCS approval of the command and control procedures for the system, and early installation of a communications cable linking Hawaii and Johnston Island. Secretary Zuckert concurred and directed that action be taken on Riepe's requests with the JCS, while the Air Staff coordinated requirements for the cable with the Defense Communications Agency.[10]

[redacted] By 13 November, Douglas Aircraft Company had published the Phase I Flight Test Plan, which had as its objective demonstration of the feasibility and capability of the system to negate a satellite by launching a missile within a restricted time frame, guiding it through vernier engine cutoff, delivering the payload to a preselected time-space point, and arming and firing the warhead at the appropriate time. The plan called for four launches. The first three were intended to demonstrate the program's feasibility, while the fourth was to demonstrate system capability.[11]

~~(S)~~ The program evolved swiftly. By 15 November, the organization and training effort had succeeded so well that the 6595th Test Squadron was inactivated and immediately reactivated as the 10th Aerospace Defense Squadron, a component of Air Defense Command's 9th Aerospace Division. Commanded by Colonel Charles E. Minihan, the unit bore the distinction of being the only "blue suit" space launch organization in the Air Force. The pace of training at Vandenberg was hectic, but there were morale-boosting compensations. Chief Master Sergeant A. J. Stotler, NCOIC, Standardization, Training, and Analysis for the squadron, recalled that "all the officers and airmen assigned to the 10th ADS were very professional and a very select group." Their training was conducted by Air Training Command's Field Training Detachment 530S and SAC's 4300th Support Squadron. Stotler remembered with pride that he and Colonel Minihan were the first squadron members to be rated as Senior Missilemen. No badges for the rating were available at the Vandenberg Base Exchange, so "Colonel Minihan gave me two brigadier general's stars and I had the mechanical maintenance shop fabricate two Senior Missilemen badges by attaching a star to the top of the Missileman badge. Since we were an ADC squadron tenant on the SAC base (Vandenberg), our status as Senior Missilemen became well known and perhaps created some jealousy among our SAC friends."[12]

(U) At Los Angeles Air Force Station (LAAFS), Major John R. Barnard was assigned to ADC's liaison office and acted for Colonel Minihan in dealings with Ballistic Missile Division's Program 437 System Program Office. He recalled that Program 437 elicited a "very positive feeling. At no time did we feel that it couldn't be done or that we were spinning our wheels doing it." There was some perception of the political concerns hedging the use of a nuclear weapon against a target in space, but the issue "never posed a problem in administering the program . . . no equivocation about implementing policy." The biggest problem, in Barnard's view, was the multiplicity of contractors involved, and the difficulties involved in coordinating their efforts. He also preceived that AFSC had a proprietary interest in the space mission and was eager to keep space operations as its exclusive preserve. Aside from organizational rivalries which occasionally produced tensions, the liaison officer felt that the military side of the effort was outstanding. "The positive attitude on the part of the Air Defense folks was superb," he emphasized. "Everybody was just set on 'GO.' People didn't mind overtime work. Overtime work was a rule rather than the exception. They went out of their way to contribute . . . . Everybody felt that they were pioneers in space."[13]

~~(S)~~ The tight schedule for getting Program 437 operational put a great deal of stress on those responsible for its management, but the project also avoided many problems because it was not blazing any new trails. Colonel Riepe later remarked:[14]

> There is no new technology in the 437 program. Actually it is drawn from equipments developed on other research and development and operational programs, and from the junkpile residue left over from them. The Thor, the guidance system, the warhead and its fusing, were all drawn from other developed systems or from systems in research and development test. In 437, as in all development and acquisition programs, the SPO's [System Project Officer] job was to see that everything needed--facilities, the equipment, and the people--were on location, on schedule, and within the funding allocated. Our biggest problems were associated with . . . the Secretary of Defense directive that the system would be operational in June of 1964. We found ourselves implementing plans for the operational phase before funding had been received on the R&D program. The first man was put into training before the R&D engineering had been started.

In concept Program 437 was simple, Colonel Riepe thought a good analogy would be to compare it to a skeet shoot on a global basis, yet the satellite interceptor system was complex when one considered all of the equipment which had to be pulled together and made to perform with unusual precision. Target satellites orbited at great speeds. Possible orbits and inclinations could vary greatly, and thus sophisticated tracking equipment, analogous to the skeet shooter's eyes and brain, was required to assist in the prediction of a target satellite's future position. The tracking and computing system had to predict an interception point near Johnston Island at least 12 hours in advance, with an accuracy of three nautical miles along the orbital path and a mile and a half across its track. The system had to be ready to launch within a critical five second time frame in order to intercept successfully and destroy a target satellite. "The most significant thing about the whole program was the precision of it," boasted a veteran; "437 had a launch window of plus or minus one second." In contrast, the later Apollo missions had a launch window of four to five minutes. "We had no margin for error," stressed a former detachment commander of the 10th Aerospace Defense Squadron.[15]

[redacted] The challenge was to achieve the proper unity of effort among the disparate organizations involved. Colonel Riepe's Program 437 team coordinated the contributions of Air Defense Command, Air Force Logistics Command, Military Air Transport Service, Air Training Command, Space Systems Division and Electronic Systems Division of Air Force Systems Command, Holmes and Narver contractors, Douglas Aircraft Corporation, Bell Telephone Laboratory, Univac Corporation, Sandia Corporation, and Joint Task Force 8, the tri-service organization charged with oversight of Johnston Island.[16] At the end of 1963, the Riepe Team's efforts encouraged Assistant Secretary McMillan to sent a memo to the USAF Chief of Staff in which he characterized as "highly satisfactory" the management of the program to date, which had:

> permitted timely accomplishment of a very satisfactory and comprehensive response to the Secretary of Defense direction . . . . Extraordinary efforts have been required. Problems have been met in an imaginative and timely manner. Diligence and talent have been demonstrated to an unusual extent, and appropriate recognition should be given.[17]

~~(S)~~ During the early weeks of 1964, plans and programs were drafted to meet the tight schedule requirements for demonstration and turnover of the system to ADC. Space Systems Division and ADC officers joined in writing an operations plan, published on 5 March. By that time, the issue of transferring logistics support from Space Systems Division to the San Bernadino Air Materiel Area of the Air Force Logistics Command had also arisen. This event was scheduled for mid-May, which meant the booster, Aerospace Ground Equipment (AGE), and other facilities were to be given to ADC within four months. This left little time for an orderly transition of support from AFSC to AFLC. The two commands collaborated in reviewing a proposed transition plan to determine if the necessary actions could in fact be accomplished within the time available. By 10 April, the transition agreement had been reviewed and forwarded to AFSC headquarters. It provided for functional support responsibilities, excepting Engineering and Configuration Management, to be transferred by 6 June 1964. Engineering and Configuration Management shifted from Space Systems Division to San Bernadino Air Materiel Area on the last day of July.[18]

~~(S)~~ While the two commands still reviewed the logistics support turnover plan, AFSC drafted a "Demonstration, Turnover and Acceptance Plan" to give ADC and AFLC a means for determining and certifying that Program 437 operational acquisition had been accomplished; that the ASAT system and the tactical unit operating it were operationally ready; and that the system would have adequate logistical support. The plan detailed the requirements and specific procedures necessary to demonstrate, evaluate, and clarify complete operational weapons system attainment to include hardware, personnel, procedures, and facilities to be acquired by the Air Force. The demonstration launch was scheduled for 28 May and the Initial Operational Capability status was to be achieved the following day.[19]

~~(S)~~ Obviously, the reliability of the equipment and the efficiency of the launch crews were critical to mission success, but equally so was the accuracy of the target data computed and submitted to the launch site by the sensors and attendant computers that had acquired the target, tracked it, analyzed its orbital characteristics, and calculated the optimum time and position for its interception. The Space Detection and Tracking System held the key to Program 437's accuracy. It had been created in the wake of Sputnik when the military services allied with the civilian scientific community to field a worldwide array of space cameras and radars to find and track all detectable objects orbiting the earth. Tracking data from these sensors was transmitted to the NORAD SPADATS Center where a catalog of space objects was maintained. At the Center the orbital elements of any space object deemed hostile could be calculated to yield target data and then fed into the computers at the Johnston Island launch site.[20]

(U) The geographical location of Johnston Island imposed certain operational constraints. The LV-2D Thor booster had an altitude of 700 nautical miles and a horizontal range of 1500 nautical miles. From the island it could engage only those satellites whose orbital parameters brought them within that relatively limited zone of engagement. An alumnus of the program later remarked that "the technical achievement of 437 was in the development of the SPACETRACK [USAF portion of SPADATS] orbit determination and targeting programs that provided the accurate prediction of the target satellite." The SPACETRACK Center accomplished all predicting, targeting, and guidance and sent to Johnston Island missile computer at least six to twelve hours before launch. The Thor missile, already a proven booster, was "an excellent choice because it provided lift-off control with a half-second, 360 degrees of launch direction freedom (keel up or down flight), and in-flight pitch and burn time control." This control extended only to the predicted point, for there was no target tracking in the intercept area. "The total system had a reasonable probability that it could achieve a point in space at the predicted time within the lethal envelope of a one megaton weapon (for orbits above the high drag altitudes, but within missile range)." Launches were always planned to permit the Baker-Nunn space camera sited on the island to photograph the interception. The Program 437 system would achieve high accuracy; during one interception the miss distance was estimated at only forty meters.[21]

~~(S)~~ Program 437's dependence upon SPACETRACK, however, meant that it was limited to engaging only those targets whose launches could be detected, tracked, and orbital paths analyzed by that array of sensors and automatic data-processing equipment. With the limitations of the system extant in 1964, it was quite possible that a satellite could be launched into orbit without ever being detected and tracked by SPACETRACK. As one Program 437 member recalled:[22]

> The launch site location did not provide for accurate orbit determination of a newly launched Soviet satellite, and passage within the targeting envelope before the satellite had overflown the US . . . . The targets were always chosen from those above the high drag altitudes because we did not have enough accurate tracker coverage around the world to predict orbits accurately in the high drag altitudes below 250 miles altitude. Since the Soviet photo birds fly below these altitudes, its not clear that we ever had much meaningful capability. What we had was the development of orbit determination software . . . and a political statement.

A NORAD analysis of SPACETRACK effectiveness in 1965 revealed that gaps in its coverage seriously affected the acquisition of targets for potential Program 437 missions. The analysis determined that any launch southeastward from the Soviet complex at Tyuratam on inclinations of less than 57° or from 65° to 80° would not pass through SPACETRACK coverage until after the vehicle's first pass over North America. At that time the sensor at Dyarbakir, Turkey, was the only one capable of detecting southeastward launches from Tyuratam.[23]

[redacted] Even if launches made from Tyuratam or any other Soviet complex could be detected and tracked immediately prior to the satellite's first passage over the United States, the system still required six to twelve hours in which to compute accurate targeting data. By that time the satellite would have passed over the United States enough times for it to accomplish any mission of bombardment, reconnaissance, navigation, or communications. Since it employed a nuclear warhead, Program 437 no doubt would be used only in the event of a full-scale thermonuclear war; and it was likely such a conflict would have passed through a decisive phase well before the ASAT could be brought into play. So from its very inception, Program 437's practical utility for deterring (or waging) a nuclear war was framed in dubious terms. Its chief value lay as a political statement that the United States was prepared to utilize space weaponry if the situation required it to take such action.[24]

[redacted] It was not for the military staffs managing Program 437 to debate the circumstances under which the system might be used; their mission was simply to ensure that Program 437 became operational on schedule and within the preordained technical limitations of the subsystems which comprised it. In theory it may have seemed a relatively simple matter of utilizing proven hardware to perform the mission within the permissible time frame; but in practice the training and preparations at Vandenberg and on Johnston Island proved a challenge to the energy, technical expertise, and managerial skills of all involved. A Thor missile was made available for two-shift training at Vandenberg, where full-time instruction had been underway for members of the 10 ADS since October 1963. The squadron members joked that in their case the acronym "ADS" meant "All Day Saturday and All Day Sunday" as the tempo of training accelerated in 1964. By that time the contractor and service personnel on the island had conducted the first of over a dozen system evaluation exercises designed to assure the reliability and efficiency of the targeting system.[25]

[redacted] As time for the first scheduled demonstration launch approached, trouble appeared on the pad. When the payload was mated to the launch vehicle, a chronic radio frequency interference (RFI) problem resulted. Each time the payload telemetry was activated the guidance system experienced interference. Colonel Riepe directed the launch site to stand down for six weeks and fix the problem. Although the Douglas-scheduled initial launch date of 3 January was not met, the problem was thoroughly analyzed and corrected in timely fashion.[26] The Douglas launch crew then rescheduled its first "shoot" for the night of 14 February 1964, and anticipation grew keener with each passing day. When the launch date finally arrived, spectators on the island saw two Thors rear above their launch pads as plumes of condensation from the super-chilled liquid oxygen in their tanks curled in billows around the white shafts of the missiles. The reserve missile was counted down alongside the primary one as a guarantee against failure. The countdown proceeded smoothly, and the primary missile ignited on schedule. There had been no launches from Johnston Island since November 1962, and the Thor's roaring engine sent the nesting seabirds screaming aloft from their nearby rookeries. Missile Number 299/59-2420 climbed steadily into the night sky, its telemetry and ground guidance data indicating a normal flight path to the intercept point. The Thor hurtled onward, climbing and then arcing to meet an interception point at an altitude of 540 nautical miles and a range of 443 nautical miles form Johnston Island on an azimuth of 290°. A Transit 2A rocket body was scheduled to sweep past that point in space and time as it pursued its 564 by 336 nautical mile orbit at an inclination of 66.7°. Minutes later the simulated warhead passed close enough to the target to be considered a successful interception. On Johnston Island the Douglas launch crew and engineers were jubilant, while Colonel Riepe was vastly relieved. Program 437 had made history; it still remained for it to be made operational.[27]

[redacted] The second research and development flight by another contractor crew was scheduled for 2 March. Once again the two-missile procedure was followed. Five and a half hours prior to launch time instruments malfunctioned on the primary missile and project officials had to replace the payload in a hurried one hour and twenty minutes. Meanwhile, the payload aboard the backup booster picked up the countdown without any problems. When the Pad Two payload had been replaced, the terminal countdown phase began, but was disrupted when a timer malfunctioned at the monitor console, automatically imposing a technical hold on the process. Douglas contractor personnel discovered they could not readily identify and correct the problem, which led to a decision to "scrub" the Pad Two missile. The terminal countdown proceeded on the backup booster, and on the night of 1 March the second Thor hurled itself into the sky in a launch and intercept that were just flawed enough to demonstrate the system's effectiveness. The main engine cutoff (MECO) occurred 4.61 seconds early for some undetermined reason, and the guidance displayed a slight error in cross range, although it remained within the system miss distance criteria. Arm and burst commands were successfully transmitted and a miss distance "within spherical error probable (SEP) of 3.4 nautical miles was obtained." Douglas engineers declared that flexibility had been effectively demonstrated. Although the second launch had not been as smooth as the first, all test objectives were met and the operation was rated a complete success.[28]

[redacted] The first two Program 437 launches completed almost all Phase I test objectives, excepting validation of operations from Pad Two. The Air Force was content to "stand down" the launch program and incorporate hardware modifications that would bring the system into full operational (Phase II) configuration. The first Phase II launch was then scheduled for 19 April. Combat Crew A of the 10 ADS was airlifted to Johnston Island to monitor activities of the Douglas contractor crew. Optimism over the program's progress resulted in cancellation of the fourth research and development launch and its rescheduling, for late May, as a completely "blue-suit" operation for the 10 ADS crew.[29]

[redacted] The third missile from Johnston Island was ready for launching on 19 April as anticipated. The countdown proceeded normally and the engine ignited, but the main liquid oxygen valve failed to open and the flight was aborted. A post-mortem conducted by Douglas engineers determined that a defective valve required replacement along with a set of four-way pneumatic valves. The replacement parts were airlifted to the atoll from California, arriving the afternoon of 20 April. They were installed and checked for proper operation by 0900 the following morning. The countdown began that afternoon, culminating in a successful third launch. Personnel of the 10 ADS observed, monitored, and assisted with the sequence of pre-launch and launch activities.[30]

[redacted] The officers and airmen of the fledgling launch crew had been training at an accelerated pace for months before being sent to the atoll, and their participation in the 21 April launch had merely whetted their expectations for executing the next missile "shoot" on their own. The Thor program veterans among them had participated in IRBM launches against surface range targets, but using the missile like a precision weapon in a celestial bird-shoot was something new and exciting. The Douglas launch crew might have been able to look upon its launches as simply paid exercises, but the men of the 10 ADS knew that on some future occasion they might be called upon to send a nuclear-tipped Thor aloft against an enemy satellite in deadly earnest.[31]

[redacted] Visiting dignitaries crowded Johnston Island as the 28 May launch date arrived. Among them was Lieutenant General Herbert B. Thatcher, ADC commander, there to see if his command was going to acquire a truly operational weapon system. As before, the countdown sequence proceeded smoothly, but the missile's exhaust flames burned through a vernier engine actuator cable upon launch, throwing the vehicle off course by fifty miles as it missed the interception point. The launch crew was understandably chagrined at the failure, but General Thatcher concurred with the findings of a post-operational critique which ruled that a defective booster and not the crew's launch procedures was at fault. The next day, 29 May, General Thatcher declared that the 10 ADS and its weapon system had achieved Initial Operational Capability. Less than seven years after the first artificial earth satellite had been placed in orbit, the USAF achieved the capability to negate such spacecraft if the necessity ever arose. The Soviet Union had issued vague boasts about an ASAT system as early as 1960, but in the last days of May 1964 the United States had made it a reality. The Air Defense Command was now in the business of space warfare. Program 437 would never carry out the mission for which it was designed, that did not diminish its significance. Like all other weapons in the American arsenal, it was an expression of the Clausewitzian maxim: "War is a continuation of politics by other means." Program 437's most significant mission would be executed not in space but in the arena of American domestic politics.[32]

NOTES

(All Notes are Unclassified)

Chapter II

1. For discussions of the Thor and its overseas deployment see Julian Hartt, The Mighty Thor: Missile in Readiness (New York, 1961), passim; Robert Jackson, Strike Force, The USAF in Britain Since 1948 (London, 1986), pp 93-98; 197; William R. Van Cleave, "The U.S. Strategic Triad," in James E. Dornan, Jr., ed, The US War Machine (New York, 1978), p 60; Norman Polmar, ed, Strategic Air Command, People, Aircraft, and Missiles (Annapolis, 1979), pp 219-20; Ltr (U), Col Philip R. Jackson, USAF Ret, to Dr Wayne R. Austerman, History Office, HQ USAF Space Command, Feb 7. 1963.

2. Memo (S/DECL OADR), Eugene M. Zuckert, Office of the Secretary, Department of the Air Force, to Chief of Staff, USAF, "Program 437," Mar 20, 1963; Paul B. Stares, The Militarization of Space US Policy, 1945-1984 (Ithaca, New York, 1985), pp 120-22.

3. Ltr (S/DECL OADR), Lt Gen Howell H. Hayes, Jr., HQ AFSC to HQ ADC (Lt Gen Robert M. Lee), "Program 437," 27 Feb 63; Ltr (S/DECL OADR), Maj Gen John K. Hester, Asst Vice Chief of Staff, HQ USAF, to AFSC, "Early Satellite Intercept Capability, Program 437," 15 Feb 63; Ltr (S/DECL OADR), Maj Gen John K. Hester, Asst Vice Chief of Staff, HQ USAF, to ADC, "Designation of User for Program 437," 15 Jul 63; Hist (S/DECL OADR) HQ Space Systems Division, AFSC, Vol 2 (Narrative), Jan-Dec 1963, pp 65-70. Despite the Air Staff's ruling in the matter, AFSC continued to take a proprietorial interest in Program 437 which extended beyond its operational debut. An ADC liaison officer with AFSC Ballistic Missile Division in the 1963-65 period recalled that AFSC's open jealousy of ADC's inheritance of a space mission worked against Program 437's rapid turnover to the user command. "They would have liked to keep space as their preserve," he remarked in a 1986 interview. Another veteran of service with the 25 ADS and 10 ADG during the 1966-68 period recalled that there was an obvious sense of reluctance and resentment displayed by AFSC personnel with whom he had dealings during the course of his tour. "They were always trying to interfere with our operation, give us advice, etc," he noted. Intvws (U), author with Col John R. Barnard, USAF Ret, 17 Sep 86, and Col Richard B. Peterson, USAF, Ret, 30 Sep 86.

4. Hist (S/DECL OADR), HQ Space Systems Division, AFSC, Vol 2 (Narrative), Jan-Dec 1963, p 70; Ltr (S/DECL OADR) Brockway McMillan, Undersecretary of the Air Force (Research and Development), to Deputy Chief of Staff, Research and Development, HQ USAF, "Program 437," 20 Mar 63.

5. Gerald T. Cantwell, "The Air Force in Space, Fiscal Year 1963" (Washington, D.C., 1965), p 72; Memo (S/DECL OADR), Secretary Zuckert to Chief of Staff, USAF, "Program 437," 20 Mar 63; Ltr (U), HQ Space Systems Division, (AFSC) to AFSC (SCOR), "Manpower Requirements for the 437 Program Missile Launch Squadron," 22 Mar 63; Special Order G-43 (U), HQ AFSC, 15 Apr 63; Ltr (S/DECL OADR), Brig Gen Richard D. Curtin, Dir of Advanced Engineering, HQ USAF, to AFSC, "Program 437," 1 Apr 63; Memo for Record (S/DECL OADR), Lt Gen Robert M. Lee, Commander, ADC, "Program 437," 30 Apr 63; Memo (S/DECL OADR), Brockway McMillan, Asst Secretary of the Air Force (Research and Development), to Dep Chief of Staff, Research and Development, "Program 437," 28 Mar 63; Ltr (U), SMSgt Howard D. Riddle, USAF, Ret, to Dr Wayne R. Austerman, History Office, HQ USAF Space Command, 14 Jan 86.

6. Hist (S/DECL OADR); HQ Space Systems Division, AFSC, Jan-Dec 1963, Vol 2, Narrative, p 71.

7. Ibid.; Ltr (S/DECL OADR), Maj Gen Richard D. Curtin, Dir of Development, DCS/Research and Development, to HQ AFSC, "Program 437 Operational Phase," 5 Jul 63; Memo (S/DECL

OADR) "Minutes of Meeting-Briefing for Secretary McNamara on Satellite Detection, Inspection and Negation, by John Whitman, DDR&E (AD)," 27 Jun 63; Stares, The Militarization of Space, p 122.

8. Hist (S/DECL OADR), HQ Space Systems Division, AFSC, Jan-Dec 1963, Vol 2, Narrative, pp 72-73.

9. James Trainor, "Non-Nuclear Anti-Satellite System in Making,"Missiles and Rockets (11 May 64), pp 12-13; Stares, The Militarization of Space, p 123; Hist (S/DECL OADR), HQ Air Defense Command Jul-Dec 64 pp 40-58.

10. Hist (S/DECL OADR), HQ Space Systems Division, AFSC, Jan-Dec 1963, Vol 2, Narrative, p 73.

11. Ibid.

12. Ltr (U), CMSgt A. J. Stotler, USAF Ret, to Dr Wayne R. Austerman, History Office, HQ USAF Space Command, 17 Sep 86; MSgt Eric G. Lemmon, "10th AERODS: Only All 'Blue-Suit' Space Launch Organization Carries Motto 'Beware Aggressor' as Mission," Mesa Missilier, 26 Oct 79, pp 4-5.

13. Interview (U), Dr Wayne R. Austerman with Col John R. Barnard, USAF Ret, 17 Sep 86; Ltr (U), Col Philip R. Jackson, USAF Ret, to Dr Wayne R. Austerman, 7 Feb 86.

14. Film (S/DECL OADR), "Program 437 Satellite Interceptor System (SAVPIN Film No. FR-444A #13).

15. Ibid; Intvw (U), author with Col Troy G. Alcorn (USAF, Ret), 17 Sep 86.

16. Film (S/DECL OADR) "Program 437 Satellite Interceptor System" (SAVPIN Film No. FR-444A #13).

17. Memo (S/DECL OADR), Brockway McMillan, Undersecretary of the Air Force, to CSAF, "Satellite Interception," 9 Dec 63.

18. Hist (S/DECL OADR), HQ Space Systems Division, AFSC, Jan-Dec 1964, Vol II, Narrative, pp 30-31, 31-32.

19. Ibid.

20. Film (S/DECL OADR) "Program 437 Satellite Interceptor System"; Stares, The Militarization of Space, pp 131-33; Ltr w/Enclosure (S/DECL OADR), RADM Allan L. Reed, Chief of Staff, DIA, to CINCAD, "SPACETRACK and SPASUR System Capabilities to Acquire Data to Fulfil . . . ," 26 Feb 65; Ltr (S/DECL OADR), Brig Gen Stebbins W. Griffith, HQ NORAD, DCS/Intelligence, to Dir, DIA, "SPACETRACK System and SPASUR System Capabilities . . . ," 19 Apr 65; Ltr (S/DECL OADR), Col Merle M. Zeine, 437 System Program Director, to ADC (ADLPW-S/Lt Col Rutter), "437AP System Capability," 17 Jun 65; Draft Manuscript (S/DECL OADR), Dr Perry Jamieson, "The Space Detection and Tracking System, 1957-1984," History Office, HQ USAF Space Command, 1984, pp 1-35; Ltr (U), Col Philip R. Jackson, USAF Ret, to Dr Wayne R. Austerman, 7 Feb 86; Ltr w/atch (S/DECL OADR), Maj Gen I. Funk, Commander, AFSC, to ADC (ADCS), "SPADATS Support of Program 437," 15 Apr 63.

21. Ltr (U), Col Philip R. Jackson, USAF Ret, to Dr Wayne R. Austerman, 7 Feb 86.

22. Ibid.

23. Ltr (S/DECL OADR), Brig Gen Stebbins W. Griffith, HQ NORAD, DCS/Intelligence to Dir, DIA, "SPACETRACK System and SPASUR System Capabilities to Acquire Data to Fulfill . . . ," 19 Apr 65.

24. Ibid.; Ltr (U), Col Philip R. Jackson, USAF Ret, to Dr Wayne R. Austerman, 7 Feb 68.

25. Film (S/DECL OADR) "Program 437 Satellite Interceptor System."

26. Ibid.

27. Briefing Paper (U), TSgt Eric G. Lemmon, 10 ADS, "Summary of Thor Missile Launches from Johnston Island," 19 Mar 76; Film (S/DECL OADR), "Program 437 Satellite Intercept System;" Stares, The Militarization of Space, pp 122-23; Hist (S/DECL OADR), HQ Space Systems Division, Historical Division, Jan-Dec 64, Vol II, Narrative, p 33.

28. Hist (S/DECL OADR), HQ Space Systems Division, Historical Division, Jan-Dec 64, Vol II, Narrative, pp 33-34.

29. Ibid.

30. Ibid., pp 34-35.

31. Ibid.; Stares, The Militarization of Space, p 123; Hist (S/DECL OADR), HQ Space Systems Division, Historical Division, Jan-Dec 64, Vol II, Narrative, pp 59-60; Gerald T. Cantwell, "The Air Force in Space, Fiscal Year 1964" (Washington, D.C., 1967), pp 60-61.

32. Hist (S/DECL OADR), HQ Air Defense Command, Jul-Dec 64, Vol I, Narrative, pp 59-60.

CHAPTER III

On Active Service (U)

(U) In the summer of 1964, Senator Barry M Goldwater, who won the Republican Party's presidential nomination, made national defense a key issue of his campaign and accused President Johnson of having neglected it. Johnson, in turn, emphasized his opponent's reputation for imprudent bellicosity while stressing his own dedication to a well-armed, vigilant, but prudent, nation which would "never negotiate out of fear, but should never fear to negotiate," as his martyred predecessor had phrased it. The Democratic administration's cancellation of the Skybolt air-to-ground missile system in late 1962, followed by its more recent throttling of the RS-70 strategic bomber program, gave the Republicans ample evidence to sustain their charges of a neglected military establishment. Johnson counterattacked by publicizing several heretofore classified military systems as a means of disproving such allegations.[1] During a 20 September speech delivered from the steps of the California state capitol building in Sacramento, Johnson unveiled the existence of an Over-the-Horizon long-range radar system, which he depicted as another guarantor against surprise attack, and two antisatellite weapons systems. The first was the US Army's Kwajalein-based Nike-Zeus experimental antiballistic missile system, which Secretary of Defense McNamara had authorized for use in an alternate ASAT mode. The other system was the USAF's brace of Thor ASATs on Johnston Island. By these revelations, "Johnston refuted this potentially damaging charge," asserted Curtis Peebles in Battle for Space. "It was now common knowledge that the US could destroy enemy satellites of whatever descriptions." Or so it seemed.[2]

(U) Johnson's assurances aside, the nation still lacked a comprehensive ASAT capability. The Nike-Zeus system could theoretically destroy satellites at an altitude of 200 miles, and on several occasions test launches of the missile had succeeded in intercepting real and theoretical targets at altitudes as high as 151 miles; but its range was clearly inferior to that of Program 437, and as early as June 1963 Secretary McNamara had informed the Army that he considered the system to be redundant in light of Program 437's projected superior capabilities. Thus the Nike-Zeus was nothing more than an interim experimental system, destined for cancellation in 1966.[3]

(U) Program 437 had achieved Initial Operational Capability nearly four months prior to Johnson's public disclosure of its existence, but the system was still struggling to reach a state of assured reliability, and its future was anything but certain as events in Southeast Asia increasingly demanded the attention of the nation's political and military leadership. Although in March 1963, Secretary of the Air Force Zuckert had identified Program 437 as a "top priority" item, events in the Gulf of Tonkin had muted that assurance by August 1964.[4]

[redacted] The Air Force had fielded Program 437 in an efficient manner, but obstacles still remained in the path of its becoming a proven and reliable element of the deterrent force. The 10 ADS had maintained one missile on full alert at Johnston Island since 29 May 1964. Full Operational Capability was accorded to the unit on 10 June, when a second Thor joined the first missile on alert status. On 16 November came the first Combat Training Launch (CTL), conducted by Combat Crew C of the 10 ADS, one of three crews rotating to the island site. This was to have been the first of three such launches scheduled annually to maintain crew proficiency, according to original planning. The 16 November launch and interception exercise was successful, but subsequent events indicated it would be the last one for much longer than either the squadron or the Air Defense Command cared to contemplate. In December 1963, ADC had learned that the Department of Defense had reduced the original procurement of sixteen Thor boosters to eight, and these were expected to sustain operations through the end of Fiscal Year 1967. Since a minimum of four missiles was required to maintain the system in operational readiness (two at Johnston Island and two in reserve at Vandenberg AFB), only four were left for ground training and CTL exercises. A second CTL conducted on 5 April very accurately placed a dummy war head within 0.89 nautical miles of the target, and inactive Transit 2-A satellite, but that reduced the CTL stockpile to two missiles. It was difficult to see how crew proficiency could be maintained with only two launches between April 1965 and 1 July 1967. Colonel Minihan framed the dilemma in the starkest possible terms: "437 must improve or die!"[5]

[redacted] Colonel Minihan and his superiors did not feel he was over-dramatizing the situation, for no sooner had Program 437 reached Full Operational Capability than the 10 ADS's mission was fragmented and its resources diverted to other ends. The 5 April 1965 launch was fated to be the last formally designated CTL conducted until 31 March 1967. For nearly two years the USAF's only operational ASAT unit would be engaged in secondary missions which undermined its ability to perform its primary mission. Although Program 437 would not die for many years yet, by 1965 it was already undergoing a metamorphosis from a weapons system to an experimental project whose combat capability would be of secondary importance. It must have been a difficult period for those who had labored hard to deploy an operational satellite-killer, only to find their efforts frustrated just as the system approached fruition.[6]

[redacted]Several factors stunted Program 437's growth. The lack of boosters could have been remedied by the September 1965 Department of Defense procurement authorization for sixteen additional Thors for CTL use from FY 1966 through FY 1971; but, as it turned out, only three more CTLs were conducted by the 10 ADS before they ended with a final launch on 27 March 1970. In mid-April 1965, Launch Emplacement (LE) II was diverted to support another mission as part of "an advanced 437 test program." This was Program 437AP, a photographic reconnaissance variant of the ASAT system which possessed similarities to the still-born SAINT project (See Chapter IV).[7]

[redacted] Program 437AP did offer some useful training for the 10 ADS and its supporting units. Its mission required the same levels of expertise needed in the antisatellite launches, and in a photographic sortie the Thor's payload had to come much closer to the target than was necessary in a nuclear interception and destruction mission. Even so, the 437AP effort unavoidably degraded the unit's ability to perform its ASAT mission, for the diversion of a launch pad to support the photographic missions meant that the dual countdown procedure could no longer be followed for the ASAT launches without either entirely canceling a conflicting scheduled 437AP mission or hurriedly exchanging its payload for a nuclear warhead. LE II on Johnston Island was devoted to the 437AP effort from April 1965 through its conclusion in July 1966. If during that period the 10 ADS had been tasked with a genuine ASAT mission, its execution conceivably could have been seriously hampered if not totally obstructed by the presence of a Program 437AP Thor on the second launching pad. This potentiality had been underscored in a July 1964 reliability assessment study conducted by the Douglas Aircraft Corporation. The contractor concluded that "overall integrated system reliability is 70 percent for a single missile countdown and 80 percent for a dual missile countdown." Although the presence of the second missile increased the odds of a successful launch by only ten percent, that could conceivably spell the difference between failure and success in a "real-world" operation.[8]

[redacted] In between its achievement of Full Operational Capability in June 1964 and its first 437AP launch in December 1966, the ASAT program was involved in some relatively minor modifications and upgrades to its equipment. The project office at AFSC's Space Systems Division completed some modifications to the system and acquired both spare parts and additional operational handbooks for the crews. A second ground station was constructed on the atoll. As early as the spring of 1965, ADC had begun planning to replace the original ground guidance system (GGS), which used a Bell Telephone Laboratories radar and Athena computer, with a new Titan radar and Univac 642B computer. The upgrade was required to give the system a 360 degree coverage of the area surrounding Johnston Island, instead of the 210 degree coverage provided by the original GGS. Work also progressed on modification of the warhead fuzing and detonator timer in the payload, so that the existing "line-of-sight" restriction for command detonation could be eliminated to allow "over the horizon" interceptions to be made.[9]

[redacted] By the end of 1964, almost all Program 437 funds had been spent. Contract overruns, outstanding contract changes notifications, and other contractual actions dealing with changes and modifications thus created some minor funding problems for the project office. At year's end, it reported it needed $1,038,414 more. The addition of the 437AP mission at the Secretary of Defense's direction assured that the program would remain funded to maintain operational capability. It was already gaining some notoriety within the Department of Defense, for on 15 July 1964, the Joint Chiefs of Staff visited NORAD/CONAD Headquarters in Colorado Springs, where they received a special briefing on the command's two operational ASAT systems (Nike-Zeus and Program 437). CONAD had assumed the JCS-assigned mission of defense against space systems, and the briefing discussed "an intelligence deficiency of major importance to NORAD/CONAD--our inadequate capability to determine the mission of foreign space vehicles." The eventual appearance of Program 437AP in operational service promised to alleviate that handicap in the command's ASAT operations, but until then informed guesswork had to suffice for the identification of potentially dangerous foreign satellites.[10]

Life and Work on Johnson Island (U)

(U) The personnel on Johnston Island faced several inacctive periods between the CTL of 5 April 1965 and the assumption of Program 437AP testing on 7 December 1965. Then followed another suspension of launch operations between the last 437AP test on 2 July 1966 and the first of the resumed series of CTLs on 31 March 1967. Although maintenance and modification efforts served to occupy much of their time, and non-launch countdown exercises could always be conducted, the men were continually confronted with the salient fact of their isolation from civilization for three months at a time. Thus the quality of life on the little atoll came to assume great importance.[11] Although both Air Micronesia and Continental Airlines made refueling stops on the atoll during their Honolulu-Kwajalein Island flights under government charters, they served mainly to emphasize the resident's sense of being poised "on the drop edge of yonder."[12]

(U) Johnston Island enjoyed a temperate climate for most of the year. The average mean temperature registered 79.3 degrees Fahrenheit, with mean rainfall measuring a little over twenty-six inches per annum. The wind blew steadily from the east at 18-24 knots, which meant that the cooling breeze was also laden with particles of sand and coral dust, giving it a rasping edge when it gusted. At times the very pleasantness and predictability of the weather became gratingly monotonous to men accustomed to the change of seasons back on the mainland. The dearth of greenery, ubiquitous coral grit, and the featureless loom of the horizon on all sides bore down heavily upon some men. Twenty years later an officer recalled that his overwhelming impression of the Pacific base was one of "the total barren bleakness of the island . . . the coral, the glare, the heat and the wind."[13]

(U) Few serious health problems developed. During three weeks in August the wind typically died down to somnolent calm and the heat became oppressive, but the use of salt tablets and prudent avoidance of over-exposure to the sun curtailed any threat of heat exhaustion. Standard attire for most officers and men consisted of a khaki service blouse and Army-issue tropical shorts. Footgear was limited to sandals or canvas-topped shoes. This ensemble was comfortable, but it also exposed its wearers to the atoll's sole major endemic health problem: coral infection. Any cut or abrasion, however minor, was quickly invaded by the airborne particles of grit and became infected. The abrasive coral dust also affected the delicate equipment associated with the launch missions. Filters and protective covers were a necessity, and preventive maintenance went on continuously to safeguard against the damage or destruction of instruments and equipment.[14]

(U) Rodents presented a potential health menace, but they were kept under control by the pack of cats that had mysteriously populated the atoll with the coming of the Americans. The felines also provided the island's twin official mascots: the Siamese cats named Sam and Pete. Sam resided with the JTF-8 island commander, while Pete was quartered with the 24th Support Squadron. Both cats had been neutered to help prevent over-breeding, but they remained aggressive ratters.[15]

(U) A variety of diversions helped sustain island morale. As always, living quarters and food were important attitudinal determinants. In the program's early months crews were quartered in tents, but by the late 1960s senior officers rated bungalow-style quarters, while their subordinates had one or two-man rooms in modern dormitory-style BOQs. Enlisted billets initially consisted of open bay-type barracks, but later "we were housed in more refined facilities," recalled an NCO, "which might be classified as luxurious by some (two-man rooms connected by a bathroom). These facilities were new at the time of occupancy by 10th ADS personnel."[16]

(U) The food in the contractor-operated dining facilities was "excellent, plentiful and contained variety. Friday night dinner usually consisted of Alaskan King Crab," noted one program veteran. "There was a New York Steak night, as well as a Prime Rib night each week. I do not recall anyone complaining about the food at Johnston Island, either while on crew duty or during the maintenance and recertification periods at Vandenberg." Liquor was readily available in the service clubs, and although weekend parties among the troops could become a little raucous at times, there was no problem with excessive drinking among the military personnel.[17]

(U) More strenuous activities also filled leisure time. Jogging was popular, and several circuits of the island could be made within an hour's run by a man in reasonably good physical condition. Tennis courts vied for patrons along with a bowling alley and a minuscule two-hole golf course, which was expanded to nine holes early in 1967. Handball and racquetball courts were also available. An island softball league provided keen competition. Games were invariably popular, if for no other reason than the free hotdogs and ten-cent beers that were available to the spectators.[18]

(U) No television reception was possible on the island, and commercial radio reception from Hawaii was poor. A resident Armed Forces Radio and Television Service station attempted to provide entertainment, and occasionally USO groups would be flown in from Hawaii for performances. Mainland entertainment usually took the form of films provided for screening in the island's 500-seat outdoor theater. It invariably rained each night during the showing, and ponchos were quickly donned as the audience sat through the downpour in determined pursuit of diversion. Unfortunately, the cinematic fare rarely merited rapt attention, for the units based in the Republic of Viet Nam received top priority for the films available, and thus the troops on Johnston Island received such memorable productions as "Billy the Kid vs. Dracula" and "Winnie the Pooh."[19]

(U) The ocean of course was the primary source of recreation. Shell collecting attracted some enthusiasts, and the men competed to see who could spot and salvage the large spherical glass floats that were often lost from Japanese fishing nets and washed ashore on the atoll. The island's lagoon teemed with moray eels and the University of Hawaii paid a bounty of a dollar per foot to support one of its marine biological research programs. Catching these ill-tempered creatures was a profitable if slightly hazardous pastime. Those not caring to don scuba gear could go shark-fishing from the shore or boats. Fish were abundant in the lagoon and ranged from four to six feet in length, although occasional ten-footers were seen. There were no shark attacks made against swimmers during Program 437's tenure on the island, but over a thousand of the finned predators were caught by fishermen.[20]

(U) Whenever the allure of the dining halls' choice viands palled, or the range of spare time diversions seemed limited, the islanders still had their justifiable pride in being the Air Force's only completely "blue suit" space launch organization to sustain their morale. With the completion of the last Program 437AP launch in July 1966, the organization rededicated itself to the original ASAT mission.

[redacted] An eight-month launch hiatus followed the final 437AP operation of 2 July 1966. During that period, training exercises for the ASAT system kept personnel confident and proficient in their duties. The upgrade of ground guidance facilities also continued through this period. A similar installation was to be constructed at Vandenberg AFB for training and support of the program. A request for $188,000 in emergency funds to construct the Johnston Island facility was approved on 8 March 1966, and personnel began training at the Univac factory the following July as plans were confirmed for the Vandenberg station. A Bureau of the Budget study challenging the imminent need for it halted work abruptly at the base in July, and as a result the original plan calling for joint occupancy of the facility by ADC and AFSC was changed to provide ADC with its own ground guidance station at the base, with occupancy scheduled for late 1968. Construction of the station proceeded unhindered, and it was completed by the end of the year.[21]

[redacted] The new guidance station brought problems with it. Acceptance and testing of GGS-2 (Building 990) was hampered by chronic radio frequency interference between the ground station and the launch emplacements. Representatives of the Sacramento Air Materiel Area (SMAMA) Field Management Team attempted to correct the problem, but to no avail. The ADC finally agreed to accept the facility on 28 February 1967, with the problem still unsolved and without a demonstration launch to test its capabilities. This was done on the condition that SMAMA agree to correct the deficiencies in the station after transfer occurred.[22]

[redacted] By that time ADC had succeeded in winning an allotment of eighteen additional Thors to support the CTL requirements through 1971, although half of them were already earmarked for use as target vehicles to support the Army's ABM program. The third CTL (and first since April 1965) was originally scheduled for 20 February 1967, but the radio frequency problem with the ground guidance station forced it to be rescheduled for 30 March. It coincided with the ADC Exercise SQUANTO TERROR 67-14, which brought the ASAT system into a simulated wartime operation for the first time. The launch proceeded flawlessly as scheduled, with the simulated warhead passing within 2.019 nautical miles of the target, a piece of American orbital debris engaged at a range of 900 miles. This launch demonstrated both the crew's proficiency and the now reliable guidance station.[23]

[redacted] On 1 January 1967 the 10 ADS was redesignated as a group, with two subordinate units reporting to it: the 25 ADS at Vandenberg AFB, and the 24th Support Squadron on Johnston Island. The 25 ADS was divided into three Combat Launch Crews, which rotated to the island from the mainland on ninety-day tours.[24] The achievement of group status presumed the unit would assume an additional mission. On 1 April 1967, the unit became responsible for the Burner II satellite launch program previously conducted by the 4300th Support Squadron (SAC).[*] That unit was deactivated on 25 May 1967, and its personnel were absorbed by the 10 ADG. The 10 ADG's unit crest bore the image of a scorpion with its stingered tail posed to strike, and the motto: "Beware Aggressor," but as 1967 faded toward 1968 the lethality of the scorpion's Thor-tipped tail became increasingly dubious.[25]

[redacted] In 1967 Program 437 confronted two threats to its continued operational status: the diversion of the Johnston Island launch facilities to support another major research and development mission for a sister service, and the ASAT system's apparent impotence in the face of a new Soviet space weapons system. In September 1967, ADC was queried on a DOD proposal to use Johnston Island as a launch site for the Thor IRBMs and Minuteman ICBMs employed as target vehicles for the US Army's experimental Nike-X ABM system on Kwajalein Island. The initial phase of the test support program called for 40 Thor launches, to be followed by the ICBM launch phase.[26]

[redacted] By late October, the test support plan had been reduced to the point where it appeared the launches would be conducted and supported by the contractor, with the first twenty-nine IRBM and ICBM launches slated from Johnston Island in July-August 1970. Subsequent launches were to continue at two or three every three months into Fiscal Year 1973. The prospective contractors for the effort, Boeing, McDonnell-Douglas, and Thompson-Ramo-Wooldridge, were to submit their bids by the close of May 1968. DOD required ADC to stand ready to support the test project, despite the crippling effect it would likely have upon the ASAT mission.[27]

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[*] [redacted] **The Burner II was an upper-stage rocket engine mounted on the Thor to launch DMSP satellites into polar orbit. All of the 10 ADG Burner II launches were conducted at Vandenberg. The last such launch occurred on 6 June 1979. The Burner II-DMSP effort was then transferred to the 394th ICBM Test and Maintenance Squadron (SAC). (Interview, author with Mr Joe Donahue, Historian, 1st Strategic Aerospace Division, Vandenberg AFB, California, 25 November 1987.)**

([redacted]) Despite the distraction posed by the Nike-X support requirement, the Air Staff authorized ADC to conduct four future Program 437 CTLs: one in FY 1968, two in FY 1969, and the last in FY 1970. This was obviously far short of the three CTL's per year (one per crew) called for in the original training plans to maintain crew proficiency. There were no additional launches from Johnston Island during 1967, but the next CTL was scheduled for February 1968.[28]

(U) The conduct of a successful CTL every month for a year would not have been sufficient to make Program 437 an effective response to the new Soviet threat that appeared in 1967: the Fractional Orbit Bombardment System (FOBS). Based upon a third-generation ICBM booster, the SS-9 "Scarp," this weapons system made its first public appearance in Moscow during the May Day parade of 1965, at which time it was described as possessing "an orbital weapons application." The booster appeared again during a celebration that November and was again identified as an "orbital rocket."[29]

(U) Despite American protests that such a system defied the 1963 United Nations ban against stationing weapons of mass destruction in space, the Soviets began long-range sub-orbital testing of their FOBS hardware late in 1965. There a 17 September 1966 orbital launch, which ended in failure, as did a second test shot on 2 November 1966. An intensive nine-launch test program followed in January through October 1967. In all, fifteen FOBS launches were conducted within a four-year period, most occurring in 1967, after which American intelligence rated the system as operational.[30]

(U) None of the Soviet FOBS launches passed over the continental United States and thus were not openly provocative, but there could be no mistake the Soviets had achieved the capability to bomb the earth from space. The operational deployment of a FOBS system by the end of 1967 (there were an estimated eighteen FOBS launchers emplaced at the Tyuratam launch complex) was doubly galling since the Soviets had signed the January 1967 United Nations' sponsored "Treaty of Principles Governing the Activities of States in the Exploration and Use of Outer Space". It specifically banned the placing in orbit "around the Earth any objects carrying nuclear weapons or any other weapons of mass destruction."[31] Whether legal or not, the Soviet FOBS had deployed a system "capable of delivering strategic weapons against US territory by utilizing Antarctic trajectories to launch a surprise attack against US command and control strategic airfields and thus disrupt its retailatory strike. Although the US development of a satellite-based missile warning system, slated for deployment in the early 1970s, promised warning of such an attack, the nation lacked the means to destroy them. These 1967 developments placed Program 437 in an uncomfortable position. As a direct ascent interception weapon it could not be charged with constituting a violation of either the United Nations General Assembly Resolution of 1963, nor the subsequent 1967 treaty, for its nuclear warhead would never enter orbit. Still, the fact that it would carry a nuclear warhead into space had given the Soviets ammunition for charges that the United States was tainting the cosmos with weapons of mass destruction, while at the same time it provided them a useful propaganda smoke screen to shield their development and deployment of FOBS.[32]

~~(S)~~ Program 437 clearly could not counter the FOBS weapon. In 1967 the system still lacked the ability to compute accurate interception data for targets in the "high drag areas" below approximately 250 miles altitude, which was where the FOBS capsules traveled, nor could Program 437 engage any launches from Tyuratam on inclinations of less than 57° or from 65° to 80°. The typical FOBS mission directed against American targets would be launched on an inclination of from 49.5° to 50°, so Program 437's island location barred it from intercepting any FOBS mission directed against the United States. Program 437 became analogous to France's Maginot Line. Both were fully capable of destroying any target that came within their range, but their fixed emplacements rendered them useless against attackers approaching from the flanks or rear.[33]

~~(S)~~ Program 437's accelerating decline in importance was marked by ADC's 17 March 1967 issuance of a Required Operational Capability (ROC) request for a new satellite interceptor system. Citing the USSR's evident intention to "pursue a military space program to achieve strategic superiority in space and thereby disrupt the deterrent balance afforded by current USAF/USSR weaponry and forces," the command petitioned the Air Staff for a "dynamic, well-planned space defense system capable of meeting space threats" in the light of Program 437's "limited effectiveness against a nonmaneuverable, identified hostile threat." The ROC called for "a coorbital interceptor . . . (to) accomplish inspection, negation and damage assessment against a more sophisticated threat. Negation by such an interceptor would permit greater flexibility and control and be less costly in terms of nuclear effects." Although Air Defense Command would never receive its non-nuclear coorbital ASAT system, its very request for such a weapon was an index to its growing disenchantment with Program 437's limited capabilities.[34]

~~(S)~~ For fourteen months, from March 1967 until May 1968, the launch emplacements stood silent on Johnston Island. The combat crews and maintenance personnel continued their 90-day rotations to and from the mainland, but the ASAT drill launchings were held in abeyance. During that period the 10 ADG crews at Vandenberg conducted three Burner II launches, but for the men on the atoll it was a frustrating time. The 25 ADS launch crews and assisting personnel from the 24th Support Squadron operated under the aegis of CONAD Operation Order 301C-67, which defined three Satellite Alert Conditions (SATCONs):

SATCON 3--- Normal readiness condition with reaction time of more than 24 hours with two missiles in readiness.

SATCON 2--- Advanced alert condition with reaction time for both missiles of five hours.

SATCON 1--- Advanced alert condition in which missiles are prepared for terminal countdown and terminal count is initiated.

CINCONAD, the JCS, or higher command authority could declare SATCON 2 or 3. SATCON 1 could be declared only by the JCS or higher authority. The order to engage a satellite would be directed by the President and issued by the JCS.[35]

[redacted] Continental Air Defense Command's operations plan provided for five types of System Readiness Exercises: I--live launch, II--dual wet countdown with simulated launch, III--one dual propellant loading and one dry missile, IV--walk/talk-through exercise, and V--special exercise requested by a component command to meet a component requirement. A number of such exercises, other than Type I, were conducted during the year. Air Defense Command orders directing the conduct of such orders were relayed to the 10 ADG by its parent organization, the 9th Aerospace Defense Division.[36]

[redacted] As 1968 opened, the Johnston Island site continued normal routine operations. In January, guidance personnel from Combat Crew B of the 25 ADS began an extensive training program under the guidance of their counterparts in Combat Crew A, as they prepared to take over ground guidance stations from the departing crew. The installation and checkout procedures for GGS-1 were completed, and it was accepted as an operational facility by Headquarters Aerospace Defense Command in March. Located in Building 100, this station's acceptance completed the two-year program of modernization and expansion of ground guidance systems. Coupled with Station 2, which had entered operation early in 1967, it provided the capability to guide a launch on any desired azimuth with a 360 degree coverage fan.[37]

[redacted] Despite the long-anticipated improvements to the site's guidance capability, the planned February CTL was delayed when the missiles on both launch emplacements had to be replaced, reducing the system to a one-missile capability for a time. On 28 February, maintenance personnel discovered that the pneumatic plumbing leading from the storage tank to the launch vehicle was contaminated with hydrocarbon. The missile on LE-1 was declared non-operational on 29 February. LE-2 remained on emergency operational status. LE-1 decontamination was completed and the missile was replaced on 29 March. It was then determined that the missile on LE-2 had suffered rust corrosion. It was replaced, and the launch emplacement was restored to full operational capability by 21 April.[38]

[redacted] With the equipment problems corrected, the launch personnel were free to concentrate on preparing for the rescheduled CTL, slated for 13 May. During the interim rust was discovered on a valve in the Liquid Oxygen (LOX) facility, a testament to the ravaging effects of the salt air upon virtually every piece of metal that suffered prolonged exposure to it. Cleaning and decontamination of the facility lasted from 6 April until 9 June, when the production of the fuel component could be safely resumed. The CTL, however, was not affected. Combat Crew C relieved the B contingent on 30 April after completing the normal required transition exercises. The new crew immediately concentrated upon the rapidly approaching CTL. On 13 May, the launch was aborted at T-90 seconds due to a lockup guidance malfunction. The fault was corrected in short order and the countdown resumed to permit a successful launching of missile No. 58-2316 from LE-1 early on the fourteenth. The target satellite, a Thor-Agena rocket body, had been in orbit since 1964. The launch proceeded smoothly, and the mock warhead registered a radial miss distance of 2.33 kilometers for a successful interception. The JCS and National Military Command Center integrated the launch into another on-going exercise that lent an added sense of urgency and realism.[39]

(U) By the autumn of 1968, Program 437 had settled into a well-established routine. Both Thors were kept continuously ready during each crew's 90-day tour. Keeping the guidance systems calibrated and supplied with the proper targeting data was the biggest challenge. Exercises were continually conducted to test both the personnel and equipment by feeding target data to the missiles' guidance systems to ensure that they remained functional. Colonel Richard B. Peterson, a 25 ADS combat crew commander, described the morale and motivation of his men in a later recollection:

> The exercises sustained their (the crews') motivation. Stressing the fact that the job had to be done with perfection by everyone . . . . We were given a mission and we performed it--certainly 99%. Each and every launch and exercise was a matter of pride in your people . . . . Every one felt that there was a definite mission to perform . . . . There was tremendous pride in the organization . . . . The only totally blue-suit people in the space business.[40]

(U) Colonel John R. Barnard, also a crew commander during the same period, shared Peterson's memories of a unit imbued with a sense of esprit de corps which generated a "very positive feeling" among all the islanders:

> At no time did we feel that it couldn't be done or that we were spinning our wheels doing it . . . . Everyone was impressed by the secrecy of it and really hyped up, but the procedures were pretty routine by then . . . . Everybody felt that they were pioneers in space . . . . As far as I was concerned we were the first military people in space with an operational mission . . . . We had hand picked troops and they were the best.[41]

(U) If the Program 437 CTLs had by this time become routine, they still attracted great interest in certain quarters. Both a 24th Support Squadron commander and a 25 ADS combat crew leader recalled that during at least two launches Soviet submarines and surface vessels were observed within ten miles of the atoll, as they monitored the American operations. They made no attempt to interfere with the launches, but their interest in the proceedings was obvious. Such sightings of Soviet vessels would be noted until the very end of the program in the 1970s.[42]

(U) Lurking Soviet submarines may have furnished a diverting topic of conversation in the island's dining halls, but of greater concern to the men servicing the Thors were the lingering effects of an earlier American operation on the atoll. On 26 July 1962, a nuclear warhead-laden Thor, being prepared for launching as part of the FISHBOWL high altitude nuclear test series, exploded and burned on LE-1 as the result of a LOX valve malfunction during the launch sequence. The warhead casing ruptured, and radioactive material was scattered over the emplacement, necessitating a massive cleanup to render the facility usable again. Throughout Program 437's occupancy of the island, the emplacement was monitored for a potential radiation hazard. The 24th Support Squadron maintained a three-man crew charged exclusively with checking radiation levels on the launching pad. Work crews were required to shower and undergo decontamination procedures after each working shift in the area. "We just kept it heavily painted. That's all we could do," recalled the former squadron commander, Colonel Troy G. Alcorn. Although no health problems ever resulted from exposure to the low-level contamination, it remained, in Alcorn's estimation, "definitely something the troops were a leery of."[43]

[redacted] The residual radiation had no effect on the conduct of duties as the year slipped into November and Combat Crew B prepared for the CTL slated for the twenty-first of the month. An ADC Operational Readiness Team evaluated both the launch crew and the 24th Support Squadron during the period 12-22 November. Both units performed admirably. The launch took place on schedule and a successful interception was made. "For the second time in the history of the 10 ADG, the combat crews were required to launch a missile during an ADC Operational Inspection," noted the group's history for the period. It was a good way to end the fourth year of the program's operational deployment.[44]

[redacted] Despite the system's superior performance to date, the long winding down of Program 437 effectively began in 1969. There were to be no launches made from the atoll during that year, for at the start of 1969 it was apparent that the Thor boosters utilized by both Program 437 and the COLLEGE LAUNCHER-Burner II operations were a dwindling resource. Aside from those already earmarked in support of those two missions, only six remained in the USAF inventory. In January it was decided that four of them would be allotted to Program 437 and two to the satellite launch effort at Vandenberg. These resources would probably support both efforts through CY 1972, but thereafter it would become necessary to begin using the "long-tank" variants of the Thor. ADC began drafting plans for that eventuality, as well as for an emergency Program 437 capability at Vandenberg for use in the event some natural catastrophe crippled the launch complex on Johnston Island. Both proposals remained subject to final Air Staff review and approval.[45]

[redacted] During the interim, the troops marked time and tried to keep their skills honed as the Thors stood ready on the island. At 0015Z on 22 March 1969, the system was reduced to C-3 readiness status when one of the missiles was declared MOCP (Missile out of Commission, Parts) due to a failed turbo-pump. The system regained C-1 status at 1500Z on 2 April when a back-up Thor was airlifted to the atoll from Vandenberg AFB and the ailing booster returned to the mainland for repair. Although sufficient boosters were still available to support the program for several more years, the Air Staff had decided to begin personnel reductions. By year's end the Directorate of Operations, HQ USAF, had directed

> . . . a reduction of 124 personnel spaces . . . from within Program 437 resources to be effective in FY 2/70. This reduction was effected by eliminating approximately one-third of the assigned missile guidance personnel from the rotational launch crews, assigning the remaining guidance technicians in a PCS status to either Vandenberg AFB or Johnston Island units and reducing the number of security police assigned to the Johnston Island unit. This latter action was made possible by maintaining the operational Thor missiles at Johnston in a de-mated configuration (nuclear payload not installed on the missiles) thereby reducing the requirements for stringent physical security of the launch pad areas. These actions will result in an annual savings of $400,000, but will not reduce the operational response or posture of the Program 437 Satellite Interceptor System . . . . Program Change Decision Z-9-107, 8 September 1969, terminates Program 437 at the end of FY 73. A reclama to this decision is not planned at this time."[46]

[redacted] The program's future grew more dim during late February 1970 as the consequence of a meeting between Secretary of the Air Force Seamans and Under Secretary McLucas. During that meeting, and subsequent ones with the Air Staff and other concerned agencies, the possibility of upgrading Program 437 to provide a new ASAT system was discussed, and AFSC was directed to prepare a technical development plan by August 1970. Yet before that work could be carried further, Deputy Secretary of Defense David Packard issued a 4 May 1970 directive that the Air Force phase down Program 437 by the end of the fiscal year. Packard based his decision on the perceived likelihood that the nation would never need the system's services. As a substitute for Program 437, Packard requested the Air Force and Army to develop low-cost technology programs for the creation of non-nuclear ASAT systems. In addition, since there seemed to be no urgent need for the 437 system, he specified that it would not be required to stand continuous alert status and that its satellite acquisition and identification functions could be performed by other systems. Under Secretary McLucas subsequently offered such an austere system as a candidate for the non-nuclear ASAT mission.[47]

([redacted]) Although its days were numbered, Program 437 remained viable within its inherent operational constraints; and there was some compensation in that the system was being relieved from supporting the Nike-X ABM testing program, which would have absorbed much of its effort and resources during the years 1970-73. System personnel remained at a high state of readiness as they prepared for the Air Defense Command exercise ARLBERG TERROR 70-7, which would see the 10 ADG conduct a live launch from Johnston Island on 27 March 1970. The mission was to certify the telemetry subsystem, which had been modified to a new frequency in the S-Band as required by AFM 100-31B, and to provide combat crew training and data for weapon system performance assessment. Missile lift-off occurred at 0737Z and interception of the target satellite was achieved following 670 seconds of flight at 902.7 nautical miles slant range and 508.4 nautical miles altitude. The mission objectives were successfully met and the miss distance was computed at only 1.1 nautical mile, well within the 3 nautical mile kill radius of the system's nuclear warhead.[48]

[redacted] It was a superb performance for a moribund system that had not been operationally exercised since May 1968. Less than a month later, the launch crew was called upon again as Johnston Island supported testing related to the Defense Subsystem Development and Demonstration Program (see Chapter IV). The Thor launch was designed to demonstrate both combat crew proficiency and feasibility of using a long wave infrared sensor in an exo-atmospheric environment to detect, acquire, track, and discriminate in track between two objects. The 25 April countdown and launch were routine, but problems arose with the experimental payload and the primary mission test objectives were not achieved.[49]

[redacted] After the long hiatus from live launches, the Johnston Island crews were suddenly under the spotlight again. During the week of 26 April through 2 May, the 25 ADS underwent an ADC Operational Readiness Inspection and Capability Inspection carried out by an ADC Inspector General Team. The unit satisfactorily demonstrated its capability to perform the ASAT mission, but was accorded a C-3 rating because only one missile was on alert status in the wake of the 25 April launch.[50]

[redacted] No doubt the 10 ADG could still perform its mission, but circumstances beyond its control had eroded its capabilities and clearly marked Program 437's future course. Because of personnel reductions on Johnston Island, program managers were obliged to downgrade the launch emplacements to a lower level of security priority. Consequently, both warheads were demated from their missiles and placed in secure storage elsewhere on the island. The necessity to remate the two warheads to their boosters prior to beginning a launch countdown increased the total system reaction time from five to eleven hours by November 1969. The eleven hour lead-time required for execution of the ASAT mission was also dependent upon such factors as the scheduling of the launch emplacement for support of other missions. No matter how keen the skills and enthusiasm of the crews might remain, the program was entering an unavoidable period of decline.[51]

[redacted] Despite the program's bleak outlook, the launch crews remained busy. On 24 September there was a launch supporting the Defense Atomic Support Agency's (DASA) High Altitude Program (HAP). The HAP was a part of the National Nuclear Test Readiness Program designed to flight-test DASA payloads preparatory to demonstrating the agency's capability to resume atmospheric testing in the event of a suspension of the nuclear test ban then in effect. The September launch made it necessary for CINCONAD to authorize downtime for LE-2 during the period of 17 May through 23 June in order to perform necessary modifications for the DASA support mission. The launch was a milestone, for it marked the last such operation to be mounted from Johnston Island by a Program 437 crew. The launch emplacements would remain silent until two final launches in September and November 1975. By that time Program 437 was only a memory.[52]

[redacted] On 31 December 1970 the 10 ADG was redesignated the 10 ADS, while the 24th and 25th ADS were inactivated and redesignated as Detachment 1, 10 ADS. This change was a consequence of Secretary Packard's May decision to begin phasing down the program by year's end. On 30 September the Joint Chiefs of Staff had approved a CONAD/ADC request to rescind the 24-hour alert requirement for Program 437. CONAD then placed the ASAT system on a 30-day recall status as of 10 October. The launch crews returned to Vandenberg AFB and the nuclear warheads were placed in storage at Nellis AFB, Nevada. A small caretaker detachment of military and contractor personnel remained on Johnston Island to maintain the launch complex. During the interim the ground guidance station was deactivated, both missiles were shipped back to Vandenberg, the LOX storage tanks were drained, and the launch facility power supply was drawn from the contractor-operated system instead of the customary generator vans. "In sum, the 437 system retained the same capability but, to put the pieces together, expanded the reaction time," the 14th Aerospace Force history noted. For all practical purposes the phase-down and the reduction of Program 437 to a theoretical 30-day recall capability were the ASAT efforts deathknell.[53]

[redacted] The 1970 exodus from the atoll marked Program 437's recessional, but it remained for the capricious elements of the ocean to strike the greatest blow against its fortunes yet sustained. Hurricane Celeste descended upon Johnston Island on 19 August as the storm's center passed within nineteen miles of the atoll base, whose personnel had already been evacuated to Hawaii. High winds and raging tides pounded the island, doing substantial damage to computer equipment and other facilities. Local repair efforts proved unsuccessful, and by late September the 10 ADS was requesting aid from the Warner Robins Air Materiel Area (WRAMA) for depot level maintenance and repair tasks. UNIVAC representatives were dispatched by WRAMA, arriving on site on 7 December. The Program 437 system was removed from service the following day.[54]

[redacted] Despite the downgrading of the ASAT system and its deferred return to operational status in the wake of the hurricane, the 10 ADS continued its ASAT mission, although the 30-day lead time required to reactivate even a system in good repair was obviously unrealistic for wartime operations. In addition, ADC funding constraints prevented the squadron from deploying to Johnston Island for an Operational Readiness Inspection, so the unit was exempted from that requirement during 1972. By that time the squadron was increasingly preoccupied with other launch missions staged from Vandenberg. Not until 20 March 1973 was the Program 437 system restored to C-1 status. That rating was more of a formality than an actual assessment of the system's existing practical utility, for on 1 June Pacific Air Forces concluded a memorandum of agreement for the transfer of its host-management responsibilities on Johnston Atoll to the Defense Nuclear Agency, to be effective on 1 July 1973.[55]

[redacted] The change in stewardship of the atoll simply marked another milestone along the path to the system's demise, still scheduled for Fiscal Year 1974. Loath to give up even a marginal ASAT capability, Air Defense Command petitioned the Air Staff on 28 August to permit retention of the mission capability while achieving equivalent financial savings. The Air Staff replied on 2 November directing the continuing phase-out of Program 437, but retention of the ASAT capability to a degree "as long as ADC maintained a Thor missile launch capability on Johnston Island." The degree to which the ASAT capability would be maintained was contingent upon the support requirements of the Defense Systems Application Program, National Nuclear Test Readiness Program, and the U.S. Army Safeguard Target Evaluation Program, all of which made demands upon the 10 ADS and the atoll launch facility.[56]

[redacted] Even this grudging reprieve for the command's ASAT mission was threatened by the pending 1 July 1974 retirement of the Program 437 warheads at Air Staff direction. Not until 2 July, the day after their scheduled retirement, did the Air Staff advise ADC that the warheads could be retained as part of an operational Program 437 until 1 April 1975. This was in line with the USAF Program Objectives Memorandum (POM), FY 75-79, which dictated complete phase-out of the system in the fourth quarter of Fiscal Year 1974. On 10 August 1974, USAF Program Management Directive (PMD) 30-0 5002 (1)/12421 F terminated Program 437 (on paper) and established the Thor Missile Launch Support Program to take its place, thus allowing the 10 ADS to keep a residual ASAT capability while it gave primary support to numerous other launch activities. The nuclear warheads were finally retired during the first two weeks of April 1975. The Program 437 system was officially retired on 1 April. Although the system had long since ceased being an operational reality, Colonel John W. Yocum, 10 ADS commander during the period of its demise, was convinced, in retrospect, that his crews could have revived Program 437 for use if need be: "It was obvious that the emphasis on the mission had been decreased considerably . . . at the same time there was still a capability there that was a deterrent." Even though Program 437 was officially interred by the Air Staff on 1 April 1975, the Soviets continued to keep a wary eye on Johnston Island. Both the September and November 1975 launches made from there in support of the Ballistic Missile Defense Target Test Program were reputedly monitored by a Soviet submarine which surfaced within sight of the atoll. The ASAT veterans of the 10 ADS could have asked for no finer compliment to their skills than that vessel's inquisitive presence.[57]

NOTES

(ALL Notes are Unclassified)

Chapter III

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CHAPTER IV

Program 437AP and Other Derivatives (U)

[redacted]) The basic Program 437 system sired an intriguing variant, which initially promised to give the United States Air Force a unique means of acquiring intelligence about Soviet spacecraft design and capabilities via direct observation of them while in orbit. Program 437AP (Alternate Payload) was rooted in Advanced Development Objective (ADO) No. 18, issued in April 1960, which stated the need for a satellite inspector-killer vehicle to be derived from Program 706, the Satellite Inspector System, which subsequently became the SAINT project.[1] By 1962, however, SAINT came under scrutiny because it was not cost-effective, and at year's end it was terminated. On 22 May 1963, AFSC directed the Space Systems Division to initiate a Program 437 definition study that would determine the practicality of assuming the satellite inspection capability originally posited for SAINT.[2]

[redacted]) Early in 1964, the Space Systems Division began work on an alternate payload package for the ASAT system. On 11 May contract negotiations were approved for modification of the SLV-2 Thor booster and design of the "X" payload it was to carry for the 437AP missions. Five days later a system program directive was issued for a 1 June implementation with the release of a General Electric Corporation contract for a study and analysis of the program.[3]

[redacted]) By August, the 437AP System Program Office (SPO) had been established in AFSC, following the closure, on 27 May, of the original Program 437 SPO in the wake of Continental Air Defense Command's declaration that the system was operational. Headquarters USAF made it clear to AFSC that the new program office was to study and evaluate the proposed system, but no operational system would be authorized until a thorough analysis of a testing program for it had been completed.[4]

[redacted]) In mid-August Space Systems Division submitted a Program Change Proposal stating that Program 437X, as it was then termed, was to be the follow-on to Program 706, with a stated capability of photographing enemy satellites. It was to be launched from Johnston Island atop a modified Thor booster. The Program Change Proposal provided an additional $14.7M in funding to the basic Program 437 effort via a reprogramming of available funds.[5]

[redacted] From August through October, Space Systems Division sought contractors for the 437AP project and identified their specific areas of work. The Atomic Energy Commission finished its work as the design construction agency for the project in August, while General Electric, Douglas Aircraft, Western Electric, Univac, and the Sandia Corporation framed and submitted work statements. General Electric received a contract on 10 September, and a work order to Douglas Aircraft followed two days later.[6]

[redacted] On 28 October, AFSC, ADC, and AFLC exchanged a Memorandum of Understanding (MOU) on Program 437AP which outlined the basic responsibilities of each command in supporting the project. AFSC was to provide the payload, with engineering and management conducted by Space Systems Division. Air Defense Command's 10 ADS was to furnish test launch facilities on Johnston Island, while AFLC was to manage support of the system.[7]

[redacted] The program evolved swiftly. By 17 February 1965, vehicle testing and assembly were underway, and a month later the system test plan, system test objectives, and target availability program documentation were completed, along with a site activation manual and the final contract with Douglas Aircraft. By 23 April, the final system test plan had been published, and on 5 May General Electric successfully mated the payload both mechanically and electrically. By the end of June, about all of the $14.7M had been expended: $9M had gone to General Electric, another $3.4M to Douglas Aircraft, $35,000 to Sandia corporation, and the balance to other minor contractors.[8]

[redacted] Meanwhile, planning proceeded for installation of ground equipment on Johnston Island. Two full duplex teletype circuits, backup equipment, and new secure communications facilities were earmarked for the launch site to support both 437AP and other AFSC-related programs. The contract was awarded to International Telephone and Telegraph/Kellog, which began installation operations aimed at meeting a completion date of 30 September 1965.[9]

[redacted] In April, the SPO issued a complete development plan for Program 437AP, which outlined its objectives and the methods by which they were to be achieved. Its basic aim was to demonstrate the "feasibility of obtaining technical intelligence photos of orbiting objects using a non-orbital interception system." The 437AP payload was to be completely interchangeable with the Thor booster, and was to include an aft bulkhead, a spacer section, a modified General Electric Mark II nonrecoverable re-entry vehicle, and an H-30A recovery re-entry vehicle carrying twin cameras in "dual rotary" configuration, an allied control subsystem, and telemetering equipment. Planning called for a program of four research and development flights to prove the system's operational utility. By 15 April, Pad II at Johnston Island had been prepared for the alternate payload mission. Resident crews had been assured that its flights would not conflict with the already operational 437 missions scheduled for the adjacent Pad I.[10]

[redacted] Five 437AP test vehicles were on contract for the program, including one development test vehicle. During the last three months of 1965, the development test vehicle was delivered to Johnston Island and all pre-flight tests were completed satisfactorily. Two of the four flight test vehicles were on the island by December, and the contractor had furnished the four Thor boosters.The complete 437AP system was in place by then and checked out for operational testing.[11]

[redacted] By the time it stood ready for its initial test flight, Program 437AP was ready to undertake a mission even more complex than that of Program 437. It deployed ever more sophisticated equipment to perform a precise function within even more demanding operational constraints. The Thor booster's expendable payload was configured something like an oil drum with a bullet-shaped superstructure added to one end. The payload vehicle contained an index camera and a primary panoramic camera housed within its protective carapace, with a clamshell door that opened to permit photography of the target vehicle once interception had been made. The exposed film was taken up on cassettes housed in the recovery capsule, which was ejected from the main payload vehicle during re-entry into the atmosphere. The ejected capsule then deployed a parachute at a pre-determined altitude and was recovered in mid-air by a specially configured C-130 aircraft operating from Hickam AFB, Hawaii. Acquisition, targeting, and guidance support were essentially the same as for the ASAT mission, but the photo-reconnaissance missions demanded supremely precise data computations and flawless system performance to achieve their objectives of obtaining usable photographs following close-range rendezvous with the target vehicle.[12]

[redacted] The 437AP had several limitations. Its booster propulsion limited intercept altitude ranges to within approximately 725 miles above the earth. Accuracy was degraded at extreme range due to the ballistic trajectory and increased time of flight. The system could not react quickly to unforeseen circumstances, because at least forty-eight hours were required to ensure proper support from the capsule recovery forces and to properly position the payload telemetry aircraft. System reaction time was thus so constrained as to permit execution only of missions scheduled well in advance. The vehicle's launch azimuth was also restricted due to the limitations of the ground guidance system and safety requirements. Launch azimuths were limited to 320 degrees clockwise to 355 degrees, and 145 degrees clockwise to 175 degrees by the extant ground guidance capability on Johnston Island and the intercept geometry. The target had to be illuminated by direct sunlight, and crossing angles in relation to it had to register 45 degrees or less due to the relative velocity constraints between the target and interceptor vehicle. A minimum of 160 seconds was required after booster separation for stabilization and orientation of the payload. An added restriction stemmed from required low angle reentry trajectories to prevent payload destruction. Maximum range was fixed at approximately 800 nautical miles. Although the Thor booster could loft the payload to 725 miles altitude, the practical maximum altitude for interception was 400 nautical miles. Minimum intercept altitude required was roughly 100 nautical miles.[13]

[redacted] Target selection obviously affected launch scheduling and reaction time. There was a dual-track system of target designation for the program. In the first case, the JCS periodically sent an approved priority listing of targets to CONAD. It indicated those targets to be photographed during a specified period. Missions were prescheduled at intervals or times compatible with the system's availability. The second target designation procedure saw the JCS direct CONAD to expedite engagement of a specific object. This target was conceivably an object recently launched or one whose imminent launching was anticipated. In such a case, mission priority was upgraded to ensure prompt and timely reaction from both the launch contingent and the mission support elements.[14]

[redacted] During periods of increased alert, two missiles with 437AP payloads were to be brought to a T-minus-8-hour status while the Thors' basic ASAT payloads were demated. (Planning called for the system to be able to change missions for a launch of a basic Program 437 warhead payload within twelve hours of the decision to execute.) During the alert period, intercept points were evaluated, targeting data refined, and guidance and mission safety procedures activated. Augmentation crews and a reserve missile with payload were readied for deployment to Johnston Island from Vandenberg AFB. The 437AP payload inventory for the launch squadron was five payload vehicles (PLVs). Two were held in ready status and one in backup status at the payload assembly building on the island. An additional backup unit and a training PLV at Vandenberg completed the inventory. Minimum time between launches was fixed at fifteen days in order to maintain at least one pad and booster for the basic Program 437 mission capability at all times.[15]

[redacted] The combat crew commander selected the launch emplacement (LE) to be used for each operational launch based upon his evaluation of both missile and launch emplacement readiness status. Two payloads were prepared for each mission, as stated, and T-minus-8-hours a primary payload was selected and mated to the designated booster. The ground guidance station to be used was selected on the basis of launch azimuth and readiness status.[16] Dual countdown preparations were followed as much as possible by using the equipment, personnel, and technical data authorized for a single countdown capability. This was accomplished by preparing the payload on the two launch emplacements alternately. The dual preparation process was suspended when it reached the point where checkout or monitoring of the backup LE/missile/payload would conflict with similar work on the primary LE/missile/payload.[17]

[redacted] Operational control and mission planning for alternate payload exercises were conducted by the CONAD Space Defense Center. Recovery services were furnished by the 6594th Aerospace Recovery Control Group under operational control of CINCONAD. Film processing support came from the Foreign Technology Division of AFSC. The Western Test Range provided telemetry aircraft. The JCS directed all launches and CONAD carried them out. Intercept points were selected to provide maximum system effectiveness within the stated political, safety, and recovery limitations.[18] The telemetry aircraft was required to be on-station at the time of interception to provide the data required for payload film development and post-mission assessment data. Priority for this service was fixed at the JCS level or higher, and, once committed, those elements of the Western Test Range required for mission support remained under CINCONAD's operational control.[19] In the unfortunate event of a primary system malfunction during the countdown preparation (and if adequate time remained), the backup missile and its payload were counted down and launched on the same target pass.

If not, the system was recycled for another mission within twenty-four hours. During the postlaunch period the 10 ADS began refurbishment of the launch pad, while a replacement missile and 437AP payload were airlifted to the site. The remaining missile reverted to alert status as directed by CINCONAD.[20]

[redacted] Following processing and analysis of the recovered mission film by the AFSC Foreign Technology Division at Wright Patterson AFB, Ohio, an interim "quick-look" report was forwarded to CONAD and ADC via the Armed Forces Courier Service. The intelligence community received detailed reports as well.[21] Mission data was collected at ADC and AFLC for post-mission analysis following formats similar to those rendered in the basic Program 437 missions. Additional specialized 437AP data included all payload vehicle telemetry (including telemetry data from the telemetry aircraft), and prints from both the index and main cameras. Accuracy of target vehicle interception, effective recovery of the film capsule, swift processing of the film, and accurate interpretation of the images it yielded were the key elements of a successful 437AP mission. As 1965 drew to a close, the alternate payload program received its first test in the execution of every phase of its mission profile.[22]

[redacted] On 7 December at 1929 MST the 10 ADS launched Thor missile Number 58-2299 skyward on an interception azimuth of 153 , the first of four planned R&D tests. The target was SPADATS Object Number 613, an expended Atlas Agena rocket body. Interception occurred 8.18 minutes after launching, following nominal lift-off, booster separation, flight path assumption, and payload operation. The camera-bearing capsule registered a miss distance value of .56 nautical miles from the programmed stand-off distance of 3.2 nautical miles. All payload functions were performed normally up to separation except for film cutting and sealing operations. Their failure was academic, however, since the data capsule was never recovered.[23]

[redacted] Under normal circumstances following target intercept, the payload vehicle would have begun a rotation sequence. Separation of the reentry vehicle's thermal cover would ensue, permitting deployment of the drogue and main parachutes. The drogue chute's deployment was also designed to pull the recoverable capsule free of the heat shield. The capsule housed the film cassette, telemetry, beacon, and a flashing light.[24] Telemetry and beacon contact with the reentry vehicle were to be established by the Surface Recovery Unit at 1940 MST (approximately three minutes after target intercept). Signals were received by the unit until 1943 MST, but the Johnston Island telemetry did not validate reentry vehicle separation. Thereafter, neither the surface nor the aerial recovery units were able to acquire signals from the reentry vehicle. Contrails and smoke were sighted by both recovery aircraft and a helicopter at 1945 MST in an area some thirty miles north of the nominal impact point. It appeared that the recovery parachute had failed to deploy properly and the subsequent water impact destroyed the capsule.[25] Subsequent data analysis by Space Systems Division indicated the malfunction was caused by a momentary short-circuit in the in-flight disconnect cable between the payload and recovery vehicles. After squib firing to provide in-flight electrical disconnection, the recovery vehicle cable terminal flew back against its own harness, causing cable damage. The momentary short circuit caused the recovery vehicle programmer to reset, which precluded physical separation of the payload and recovery vehicles. Although the design deficiency could be corrected prior to the second launch, the date for it had to be rescheduled from 28 December 1965 to 17 January 1966. During the interim, physical protection was devised for the in-flight disconnect cable and power-supply redundancy was provided to the recovery vehicle programmer.[26]

[redacted] The next two missions were flawless. The second of four 437AP R&D launches was targeted against SPADATS Object Number 922, another Atlas Agena rocket body. Launch preparations proceeded satisfactorily until the deteriorating weather conditions in the recovery area forced a cancellation of the operation on the scheduled launch date. The rescheduled event was set for 18 January, with the target being another Atlas Agena rocket body.[27] At 1111 MST the Thor left the launching pad and successfully intercepted the target. In a smooth-flowing sequence of events the film canister was recovered and the exposed film extracted for development and analysis. The test went so well that high confidence reigned as the preparations for the third launch in the series proceeded. The third payload vehicle arrived on the island on 9 February and a simulated countdown nineteen days later ensured that both the vehicle and payload were ready for the mission. The 12 March launch again marked the successful performance of all research and development feasibility demonstration objectives. The results were so encouraging that Colonel Merle M. Zeine, SSD Program Director, recommended cancellation of the fourth launch and use of the remaining payload either as part of the proposed operational system or to support another project. Both Systems Command and the Air Staff concurred.[28]

[redacted] Program 437AP thus entered a brief period of limbo awaiting approval of the follow-on plan for development and operations. Although it was soon assigned an operational mission, results fell short of expectations. The National Aeronautics and Space Administration (NASA) had launched its Orbiting Astronomical Observatory I (OAO-I) on 8 April 1966. The craft assumed a nearly perfect 500 nautical mile circular orbit, but an apparent power failure on the second day of operations had crippled it. NASA asked the Air Force to use the fourth 437AP payload to photograph the ailing vehicle, and on 17 April HQ USAF agreed. A successful simulated countdown ensued on 18 June, verifying that both booster and payload were primed for the mission. The launch occurred as planned on 2 July, but an electrical short in the system diverted the vehicle from its programmed orbit. The camera could not acquire the target and consequently photographed only the void of space, transforming the mission into what one official account described as "an ignominious failure."[29]

[redacted] Despite this failure, the program office still had high hopes for 437AP. Briefings on the operational preliminary system package plan followed to both the AFSC and Air Staff; they counted on the R&D launches' demonstration of the feasibility of a photographic satellite inspection to sell the program. It already had the strong support of both operational commanders and the intelligence community.[30]

[redacted] Even before the initial R&D flight, the Air Force had studied the possibility of mounting photographic reconnaissance missions against Soviet satellites. As early as October 1964, General John K. Gerhart, CINCONAD, had urged the JCS to look beyond Program 437AP to allocate both a mission and funds for systems that would "assure that CONAD's requirements for a co-orbital satellite inspector will be met on a timely basis." In September 1965, CONAD and AFSC urged using one of the upcoming launches to photograph a Soviet space vehicle. These proposed flights, nicknamed "Stone Marten," held the potential for yielding valuable intelligence data on Soviet spacecraft, albeit at some political risk should the Soviets discover the covert camera work and decide to make an issue of it in the United Nations. The existing system would set a valuable precedent for follow-on systems performing similar missions if it succeeded in producing useful intelligence on earth orbiting Soviet space vehicles. Thus Program 437AP was probably viewed as being more valuable as a seedbearer for future missions and systems to execute them than as an operational system in its own right.[31]

[redacted] Interest in directing the system against Soviet targets remained keen, and in March 1966 CINCONAD requested that the fourth 437AP R&D launch be scheduled for 6 April against a Soviet space vehicle. The Air Staff favored it, but recognizing the sensitivity of such an undertaking it sought the approval of both the JCS and the United States Intelligence Board. In April, both agencies disapproved employing 437AP against any foreign target. However, recognizing that a changing situation might require such a capability in the future, the intelligence community recommended acquisition of a 437AP operational standby capability. "Specifically, the recommendation is for an inventory of approximately five vehicles plus the minimum additional quantity required for proficiency launch training and product improvement testing," noted the Air Staff advisory to AFSC, which also requested a new plan to provide the required capability. The Air Staff wanted provisions made for two types of photographic system improvements. These entailed: "those to refine the present capability which could be retrofitted with relative ease into the initial system hardware, and those more significant developments which lend themselves to testing as 'piggybacks' aboard 437AP vehicles."[32]

[redacted] Although optimism over both an emerging mission and improved technology for its execution would ultimately prove ill-founded, in 1966 the alternate payload variant of Program 437 held promise of an enduring future. By late April, both ADC and AFSC had tentatively agreed to ten 437AP launches during the 1967-69 period, at an additional cost of $24.3 million. Unlike the original ASAT concept, which had been approved with deep reservations by the Defense Department's civilian leadership, the reconnaissance/intelligence capability promised by 437AP and its derivatives initially earned warmer support. In a memorandum to Secretary of Defense McNamara, Secretary of the Air Force Harold Brown cited the intelligence community's request for such an enhanced capability, characterized current capabilities in the area as poor, and forecast "the distinct possibility of a future requirement for its use."[33] But despite such support, the 437AP effort ran afoul of political and diplomatic considerations. The United States Intelligence Board recommended that launches from Johnston Island were inadvisable, for President Johnson had already publicly referred to it as an "antisatellite base," and the Soviets were certain to realize it if one of their space vehicles was the target of a 437AP launch. Not wishing to jeopardize any follow-on program, the Board suggested the Air Force consider launching such missions from a CONUS site not previously linked to the ASAT program. This complication was not welcomed, since the costs of duplicating another operational 437AP site would be prohibitive. Whatever the ultimate reason, the Air Staff decided against the photo-reconnaissance derivative of the basic system. On 30 November 1966, HQ USAF informed the program office that the plan for a standby 437AP capability had been disapproved, "thus terminating the program." Obviously, there had been a change of heart about the system's practical utility among people at the highest levels in the Department of Defense.[34]

[redacted]) Yet another proposal, one to modify the basic 437 system, also came to naught. By the spring of 1966, Air Defense Command was pressing for modification of the system to "permit the weapon system (and potential follow-on systems) to operate in an electronic countermeasures (ECM) environment." The command feared that existing Soviet electronic warfare technology would negate the weapon system's operational capability, and said that such negation efforts must already have been directed against it. The modification proposal submitted by ADC on 22 June 1966 noted that field tests at Vandenberg AFB had already proved the ground equipment was vulnerable to ECM. The booster control and payload control devices were also theoretically vulnerable, since an extremely low false command signal to these control systems could defeat the mission. This was particularly disquieting because there had been several instances of 437 system interference which exhibited ECM characteristics. The ADC proposal emphasized the continuing nature of the threat, noting that "historically, electronic counter-countermeasures (ECCM) have not been incorporated into new systems soon enough. A Program 437 EW capability must be funded, researched, and developed as soon as possible."[35] By 2 September the proposal had been reviewed and disapproved by HQ USAF on the grounds pending "further definition of the threat in conjunction with the remote site and total 437 capability . . . ." Air Defense Command attempted at least a partial response to the ECM threat by providing a recognition and analysis capability on Johnston Island, which could provide information indicating the presence of such activity prior to a launching.[36]

[redacted]) The ASAT mission inspired other variations. Both ARPA and the Air Force had studied non-nuclear satellite negation methods well before the decision to develop the nuclear Program 437 of an operational ASAT. Conventional and even non-explosive kinetic-kill warheads were considered as well as co-orbital or direct ascent interceptions based upon radar or infrared ranging methods. As early as 7 February 1963, Harold Brown had earmarked $10 million in the 1964 budget for Air Force research on a conventional-warhead ASAT system. This followed ARPA's own $12 million expenditure on the same type of system. By that summer, Brown was urging the service to use Program 437 as the basis of its future research on advanced guidance and conventional kill methods. The Air Force already had its own ideas on what constituted the best successor to Program 437. This was Program 893, which envisioned the use of modified Minuteman II ICBMs as satellite-killers. The program was squelched, however, in December 1963, when Assistant Secretary of the Air Force for Research and Development Brockway McMillan informed the Chief of Staff that approval of a separate follow-on system was very unlikely, and that such research should be linked solely to Program 437.[37]

[redacted]) As Program 437 neared completion, a program office study group formulated a concept for a follow-on system designated as 437Y. The program office drafted a Preliminary Technical Development Plan (PTDP), dated 11 May 1964, which proposed an interceptor vehicle capable of destroying an enemy satellite by conventional means. In October 1964, the Air Staff authorized design study competition for the program, but deferred approval until the studies could be analyzed and additional experience garnered from Program 437 and 437AP launches. On 25 February 1965, the program office released requests for proposals from companies to develop 437Y, which was soon redesignated Program 922. Ling-Temco Vought (LTV) Astronautics Division, Hughes Aircraft Corporation, and Northrup Space Laboratories were selected to produce parallel designs. Design work commenced on 21 May and continued through 21 September. In April 1966, a source selection board awarded a Phase II development contract to LTV, but hardware development was deferred when the Air Force funded an additional LTV study and pre-development work through the close of March 1967.[38] Hardware development did not begin until 5 June 1967 when LTV selected Autonetics to develop and produce infrared sensors for the payload homing vehicle. McDonnell Douglas received a program office contract to integrate the LTV payload and Thor booster as well as perform all ground modifications required for the flight test program. Though the 922 payload vehicle was to be mated with the Thor, the vehicle was also intended to be compatible with Minuteman, Polaris, and Nike-Zeus boosters in the future.[39]

([redacted]) Program 922 was intended to demonstrate "a terminal homing vehicle capable of interception and non-nuclear kill of exo-atmospheric vehicles." As such it was critically dependent upon precise guidance data derived from the Spacetrack system that supported Program 437, and the accurate computation of that data by the computer complex on Johnston Island. Once launched, the radio-guided booster was commanded to fall away as the infrared homing vehicle searched for, acquired, and homed on the target. As the homing vehicle came within range of the targeted satellite or reentry vehicle its warhead would detonate and drive rod-like projectiles into the target.[40]

([redacted]) The program office planned eight demonstration launches from Johnston Island. Four were designed to demonstrate satellite interception while the rest were intended to intercept re-entry vehicles launched from Vandenberg AFB. A thirty-five month development program was anticipated at a cost of $25.6 million in 1968 alone to cover additional construction and modification of existing launch facilities on Johnston Island. The entire four-year development and demonstration phase of the effort was expected to cost $57.33 million, with the first launch planned for late March 1969. From the start the program was assured very little of that money. On 5 June, when Phase II work began, only $1.8 million was available to fund the program's start and keep it on schedule until mid-July, when additional funding would be required.[41]

~~(S)~~ The initial increment of funding might just as well have been saved, for the program was doomed by the Defense Department's growing indifference to the ASAT issue, coupled with the financial demands of the Viet Nam War. Also, on 18 September 1967 Secretary of Defense McNamara announced the decision to deploy the Army's $5 billion Sentinel anti-ballistic missile defense system. This decision really marked the cancellation of Program 922, although the decision to terminate it was not officially made until 3 February 1968. Other contributing factors were the appearance of the Soviet Fractional Orbital Bombardment System (FOBS) threat and the recognition by the upper echelons of the Defense Department that the long-wave infrared technology (LWIR) derived from Program 922 might be put to more effective immediate use in ballistic missile defense.[42]

~~(S)~~ By the close of 1967, Program 922 was in serious trouble, and thus the 3 February 1968 cancellation order from the Director of Defense Research and Engineering came as no surprise. Portions of Program 922 continued in the guise of a minimum basic technology program to explore elements of potential value to the sentinel and Nike-X programs. Dubbed the Defense Subsystem Development and Demonstration Program (DSSDD), the project was intended to demonstrate the feasibility of applying a throttleable, liquid-fuelled rocket maneuverable engine, spinning rod warhead, LWIR guidance system, and small miss distance interception capability to the Army ABM programs.[43]

~~(S)~~ DSDD received $1 million in USAF funding from the Fiscal Year 1969 budget and $9 million more came from Army funds. As described in Development Directive No. 135, issued on 21 March 1968, the technology and design developed for Program 922 were to be advanced to "allow not only satellite destruction but missile interception as well."[44] Despite its new lease on life, the DSDD derivative of Program 437 began its career with some degree of funding uncertainty. In September 1968, Headquarters USAF indicated that $10M was allocated for DSDD in fiscal year 1969 with $20M to follow in 1970. That amount was subsequently cut to $12.9 million, but the aggregate still seemed sufficient to support demonstration flight test of a vehicle/payload combination capable of searching for, acquiring, and tracking an incoming reentry vehicle under simulated interception conditions. A second phase was planned to demonstrate the feasibility of using LWIR guidance and conventional warheads to intercept and destroy ballistic missile reentry vehicles during their mid-course trajectories. The first test launching was planned for December 1969, with a second to follow in May 1970.[45]

[redacted] Although the funding did prove adequate to support assembly, testing, and delivery of a test vehicle to Johnston Island during the first half of fiscal year 1969, the initial test launch was deferred. The Program 437 launch crews conducted two mock DSDD launch exercises during the interim, which involved worldwide coordination of target tracking and timing of the launch vehicle countdown. McDonnell Douglas and LTV, the program contractors, then continued preparations for the demonstration launch that occurred on 24 April 1970. With a specific mission to "demonstrate the capability of the payload vehicle (PLV) system to search for, acquire, and track a target under conditions simulating intercept using LWIR technology," the Thor LV-2D vehicle lifted off the pad at 13.66 minutes after the launching of a Minuteman II/Mark II reentry vehicle from Vandenberg AFB. The target vehicle was programmed to impact in the vicinity of Kwajalein Atoll, but problems developed aboard both vehicles. The Minuteman's reentry vehicle remained locked to the booster's third stage until reentry, while the Thor booster vibrated excessively and the main engine cutoff occurred 6.01 seconds too soon. The payload vehicle separated from the Thor, but only one of its cold gas system thrusters fired as it did so. Thirty-eight seconds after separation the payload vehicle and the booster collided. Even had this incident not been fatal to the mission, the shrouds over the sensors also failed to retract, so this would have prevented target acquisition under any circumstances. Ironically, other vehicle and payload subsystems functioned well despite the collision, lending validity to timing target vehicle tracking functions, while the launch and early booster flight indicated the validity of the system concept.[46]

[redacted] The plunging contrails over the Pacific that marked the twin failures of the Thor and Minuteman also signaled the end of DSDD. The program had been in trouble even before the failed launch. Late delivery of the test payloads by the contractor had delayed the launch by five months until that April, as well as producing a $2.6 million funding deficit for 1970. In December 1969, the Air Force had appealed to the Army Ballistic Missile Defense Agency for funding support, but ABMDA had advised that a single test flight would satisfy its requirements for the program, provided that it was successful, with support for a second flight being contingent upon that result. Thus the failure of the 24 April 1970 launch doomed the entire program. On 26 May 1970 Headquarters USAF ordered "necessary action to terminate the program."[47]

[redacted] The demise of DSDD marked the end of efforts to devise a follow-on system derived from the Program 437 technology, and the entire concept of fielding an operational ASAT system soon fell out of favor. There was a brief attempt to field a project known as Defense III, which cobbled together elements of Program 437, the DSDD program, and Project Apollo's Lunar Excursion Module (LEM) engine to form an ASAT system, but a lack of support from the Office of the Secretary of Defense led to its cancellation in the fall of 1970. In December 1971, RCA submitted an unsolicited proposal to develop a "coorbital satellite interceptor,"which was designed to detect and verify the presence of nuclear weapons aboard orbital vehicles, but it was rejected as being "impractical, expensive, and overly optimistic in terms of schedule." By early 1973, an Air Force study conducted at the DDR&E's request had concluded that although a non-nuclear satellite interceptor was well within the current range of technology, it was pointless to pursue such a capability unless the Office of the Secretary of Defense was willing to deploy an operational system.[48]

[redacted] Given the inherent limitations of the Johnston Island-based Thor booster as a carrier for any satellite inspection or negation system, it was just as well that no major effort followed on the heels of Program 437AP, Program 922, or the DSDD. The "piggybacking" of these programs upon the slim resources of the existing Program 437 ASAT system simply served to diminish that asset's already limited capabilities. The pursuit of new missions would have further undercut its capabilities to perform the basic mission while offering no marked advantage in the execution of new missions. Had another booster with longer range and a more flexible basing option been adopted for the new systems, they might have boasted some merit, but adapting Program 437 to serve as the nucleus of an operational conventional ASAT or satellite inspection system was much like fitting a telescopic, infrared sight and a flash suppressor to a muzzle-loading rifle and expecting it to be an effective sniper's weapon in a modern war. At their best these "follow-on" systems promised little more than a further extrapolation of limited capabilities via technical ingenuity from an already outmoded resource base.

NOTES

(All Notes are Unclassified)

Chapter IV

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Conclusion (U)

(U) The curious and lengthy career of Program 437 resulted from a fateful confluence of motives of the military and civilian leadership of the Defense Department. In the early 1960s, the USAF was eager to consolidate its position as the pre-eminent military service in space by deploying a weapon system which would operate there. The DOD's civilian leadership, while it feared acceleration of the arms race, also wished to avoid politically motivated charges that it had compromised national security by not guarding against aggression from space. Both accepted the nuclear ASAT as a regrettable but necessary expedient to be used only in the most dire circumstances.

(U) Program 437 did what it was designed to do, but it was not permitted to do it for long. After 18 months devotion to their primary mission, the Johnston Island launchers were diverted to work on experimental variants of the basic system while ostensively maintaining their ASAT mission. Training consequently suffered. The program had been scheduled for a minimum of three launches a year to maintain crew proficiency, yet a shortage of boosters, the distractions of additional missions, and funding cuts prevented no more than six launches throughout the system's lifetime.

(U) Those who made the system work could be proud of their achievement. At relatively minor cost, they bent existing technology to the service of a new mission and created a system reliable and effective within the limits of its inherent operational constraints. All were well aware of its limitations. Colonel Richard B. Peterson, former flight commander and Deputy Commander for Operations, 10th Aerospace Defense Group, recalled the system was innovative in that it was the only one the nation had to intercept space vehicles: " . . . we could knock one down. [but] That's all we could do . . . I do not think it could ever be deployed widely enough to be an effective weapon system."[1] Another former launch crew member thought the system would only be used under dire provocation, and the search went on for a substitute: " . . . the continuous rod warhead and other applications that were in the mill . . . [for] we were not accurate enough to use conventional warheads."[2] Colonel Troy G. Alcorn, former commander of the 24th Support Squadron, emphasized that Program 437 " . . . opened the door to the use of high explosive warheads. [but] As a weapons system it was questionable.[3]

(U) The nuclear ASAT was, in fact, developed and deployed in the knowledge that its operational use would not only destroy its Soviet target but would in all probability cripple every other satellite, friendly or not, within a radius of several thousand miles. As early as 1958, the U.S. had learned that satellites could be damaged by contact with radiation trapped within the earth's magnetic field; and in 1962 high altitude nuclear tests from Johnston Island had damaged several satellites and sent a disruptive pulse of electromagnetic radiation through earthbound electronic circuity as far away as Hawaii.

(U) Cancellation came due to a variety of factors. The Vietnam War took an increasingly larger share of the Air Force budget, and space programs suffered. American credence in the Soviet Union's assurances that it intended to honor the provisions of the 1963 United Nations Resolution 1844 on the "Stationing of Weapons of Mass Destruction in Space," and the subsequent 1967 United Nations "Treaty of Principles Governing the Activities of States in Exploration and Use of Outer Space," also seem to have reduced the necessity for any ASAT, while casting a nuclear armed one in a light of dubious legality. But had there been neither a Vietnam War nor increased optimism over Soviet intentions in space, Program 437 would still have encountered a steadily declining number of Thor boosters and the Soviet's increasing preference for placing their satellites in orbits beyond the reach of the Johnston Island site. With the phasedown of operations on Johnston Island in 1970, the system's credibility declined rapidly. The reconstruction of facilities damaged by Hurricane Celeste in 1972 was prompted more by the need to support other test programs there than by an urgency to get the ASAT back in operation.

(U) We are left with the recollection of Program 437 as a flawed system which managed to serve as a partial and brief answer to the problem of satellite interception. At its worst, it was a crude weapon of limited capability; at its best, it was the vanguard of the Air Force's efforts to extend the shield of deterrence into space, and a bright example of the American trait of ingenuity and talent for extemporization from the knowledge and resources on hand.

NOTES

(All Notes are Unclassified)

Conclusion

1. Intvw (U), author with Col Richard B. Peterson, USAF Ret, 30 Sep 86.
2. Intvw (U), author with Col John R. Barnard, USAF Ret, 17 Sep 86.
3. Intvw (U) author with Col Troy G. Alcorn, USAF Ret, 26 Aug 86.

APPENDIX I

(All portions of this Appendix are Unclassified)

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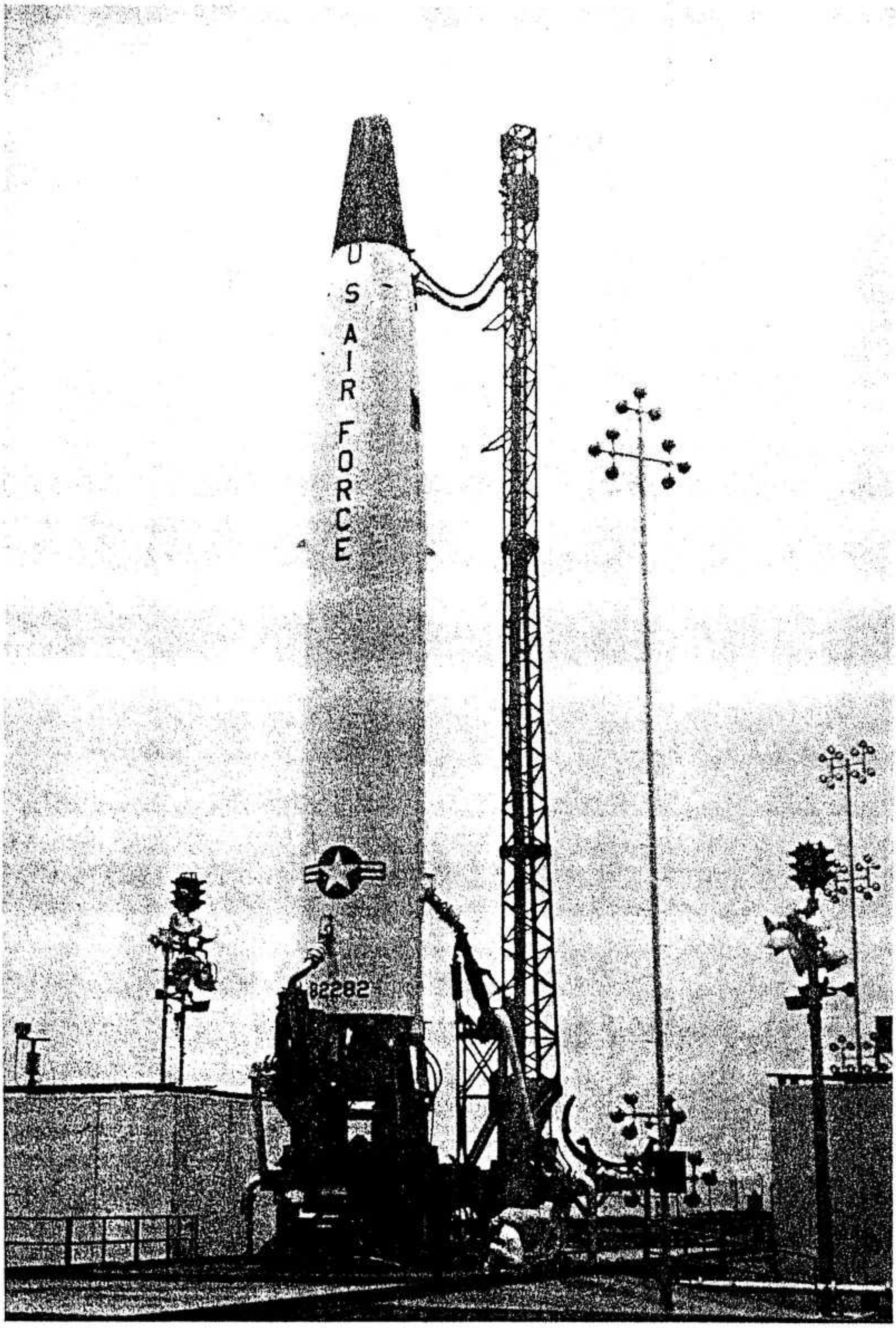
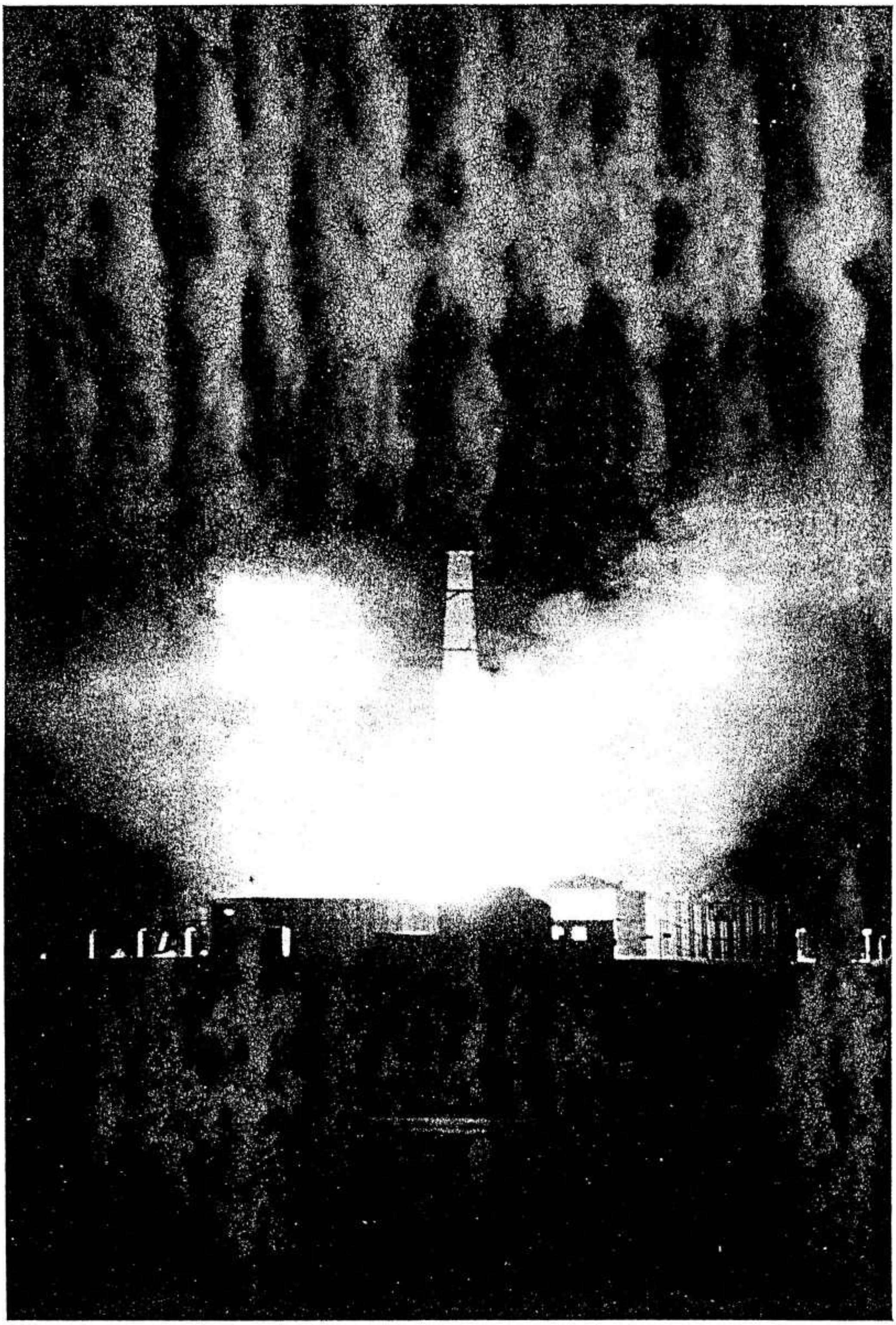
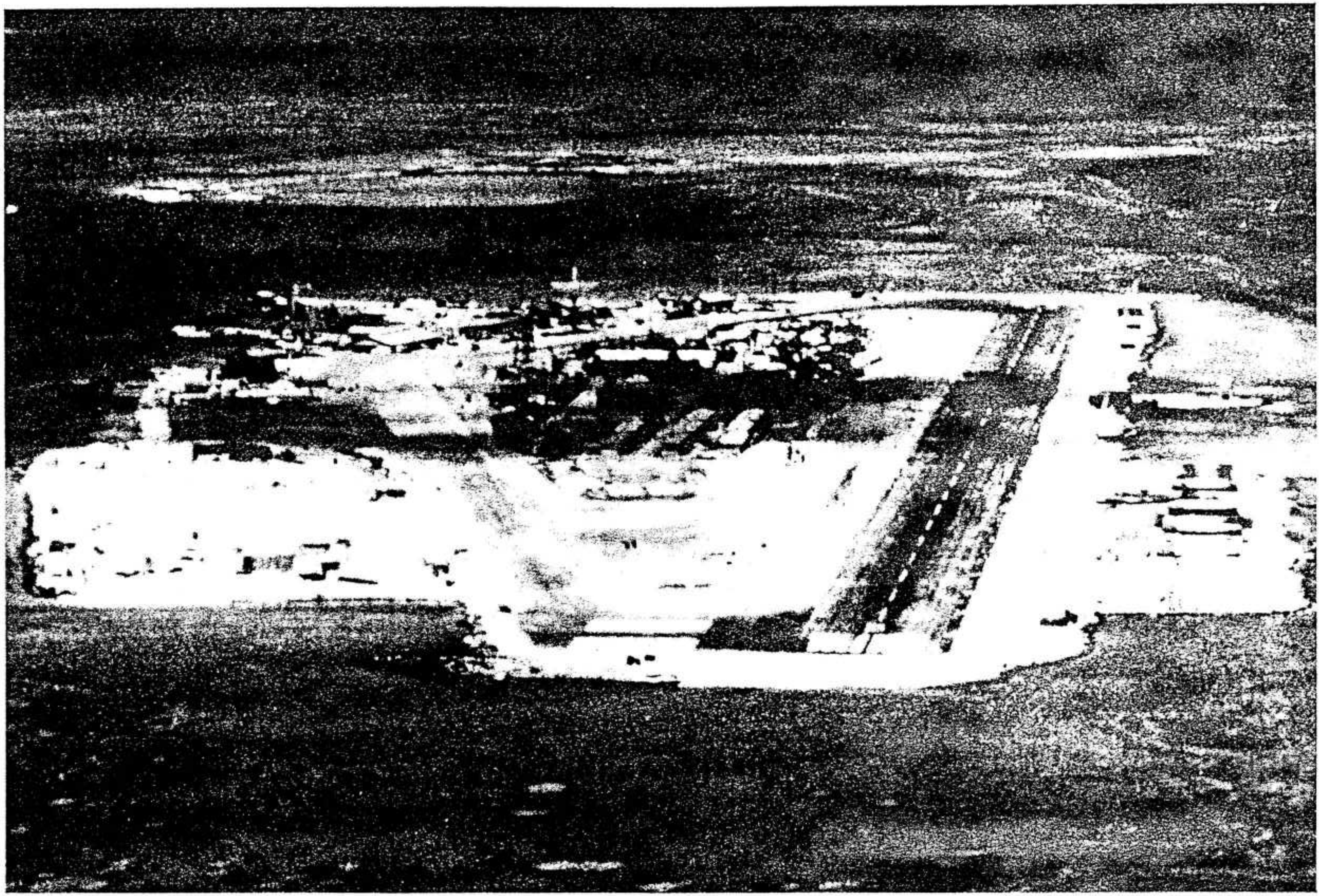


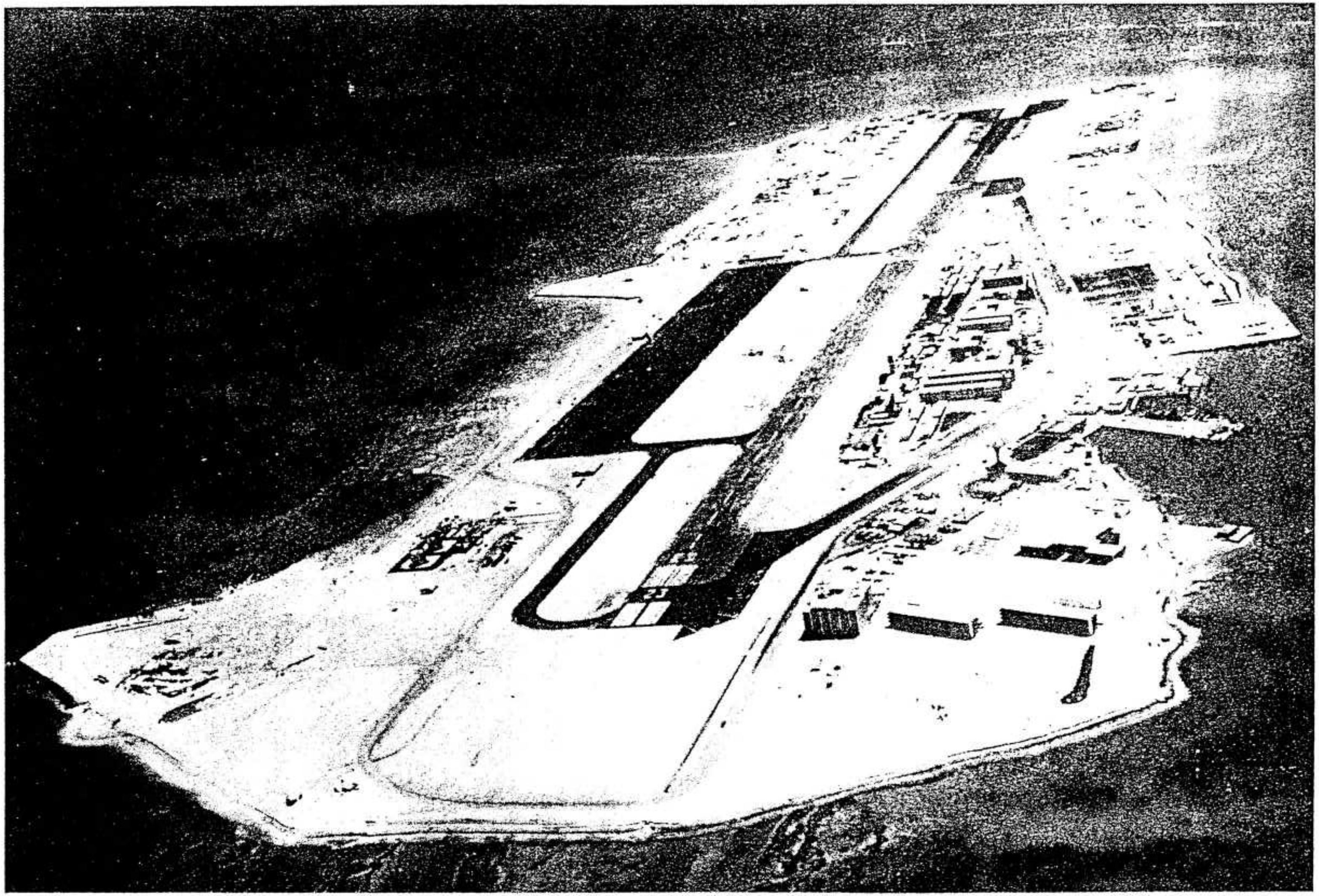
Thor Number 58-2282 sits on Launch Pad 6 at Vandenberg AFB, California. This booster was not part of Program 437. It was launched by 10 ADS personnel in support of the Burner II program on 29 June 1967. (Photo Courtesy of Colonel Troy Alcorn)



Night launch of a Program 437 Thor from Johnston Island
(Photo Courtesy of Colonel Troy Alcorn)

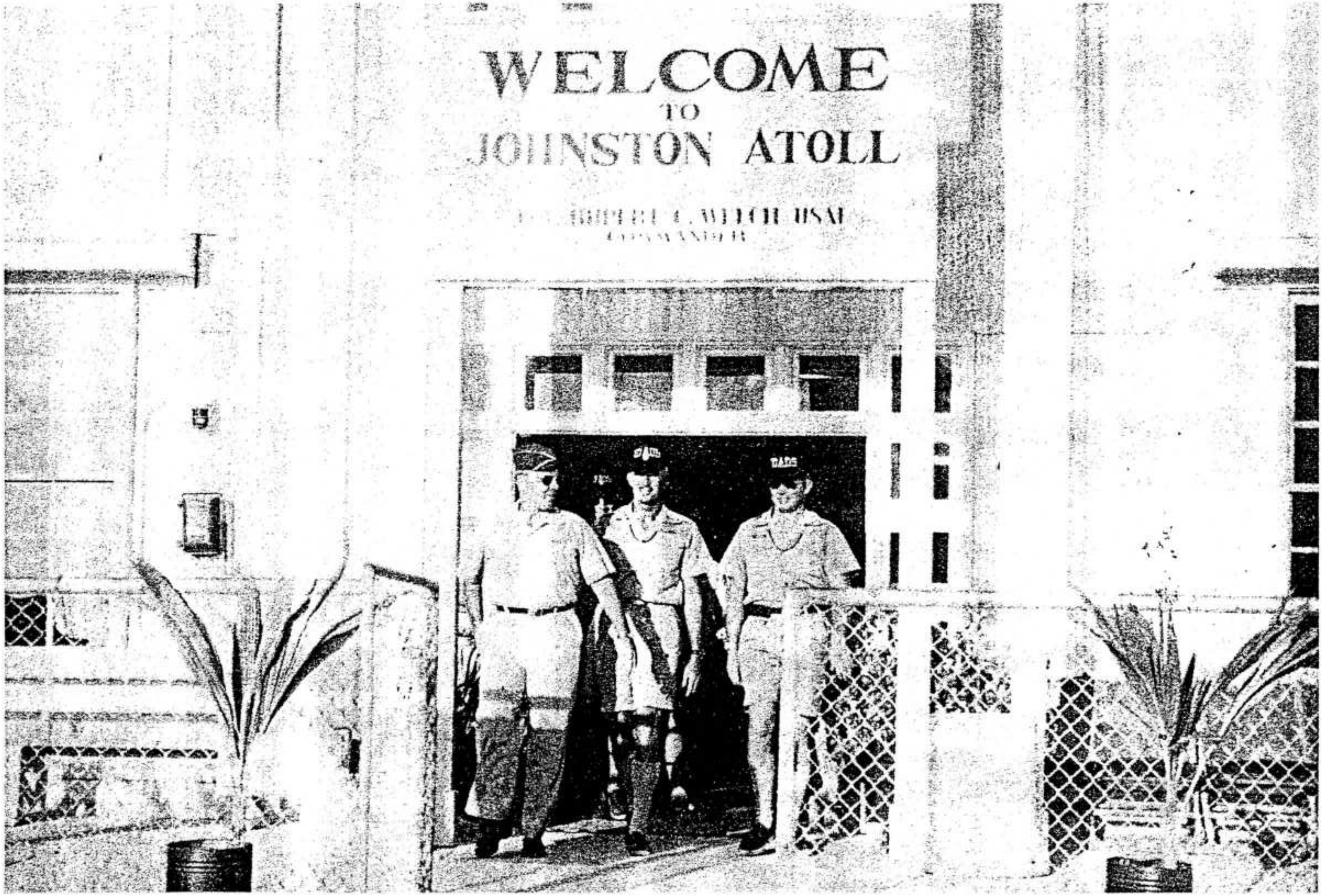


An aerial view of Johnston Island taken prior to
the expansion program required to support Program 437
(Photo Courtesy of Colonel Troy Alcorn)

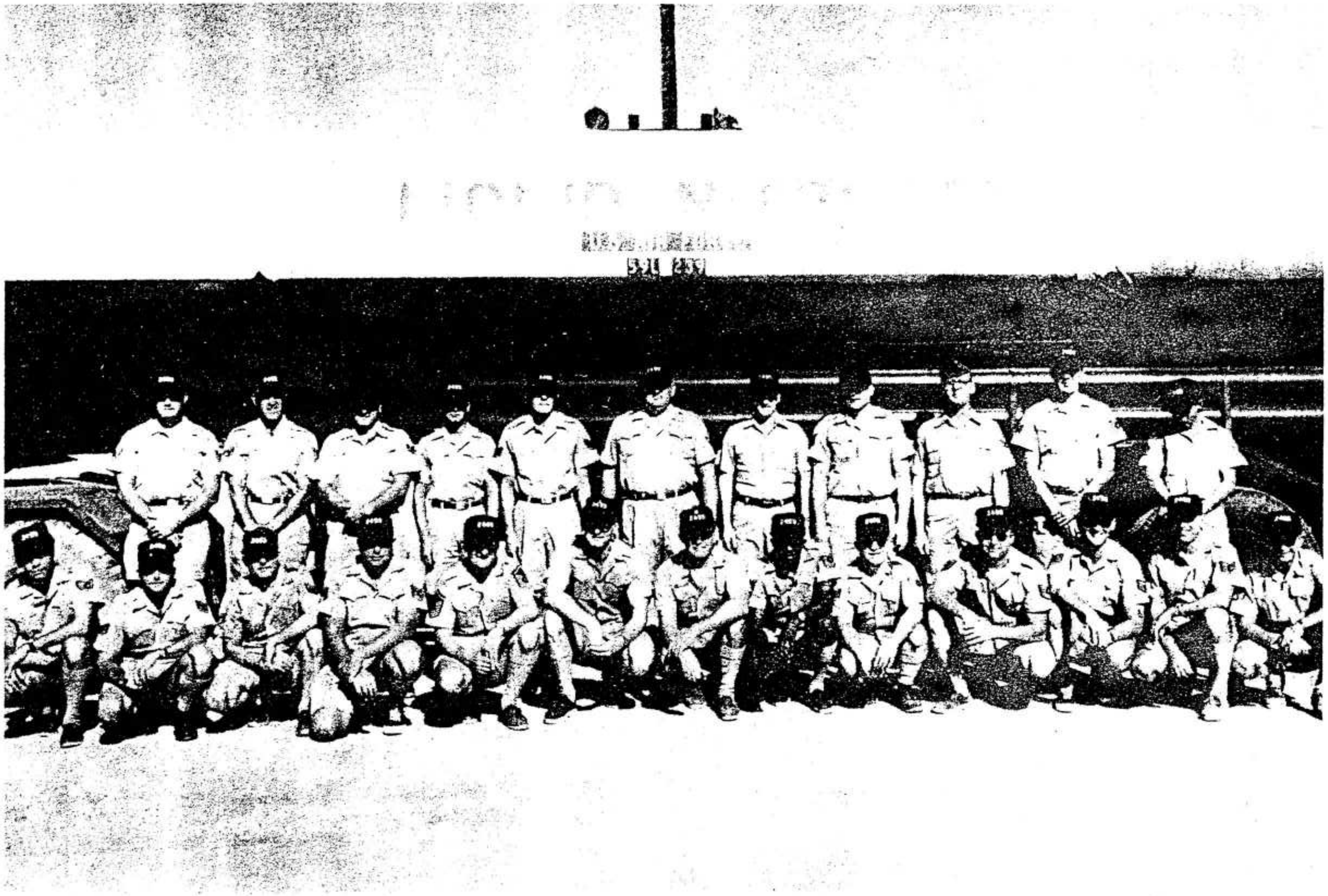


An aerial view of Johnston Island taken after
the activation of Program 437
(Photo courtesy of Colonel Troy Alcorn)

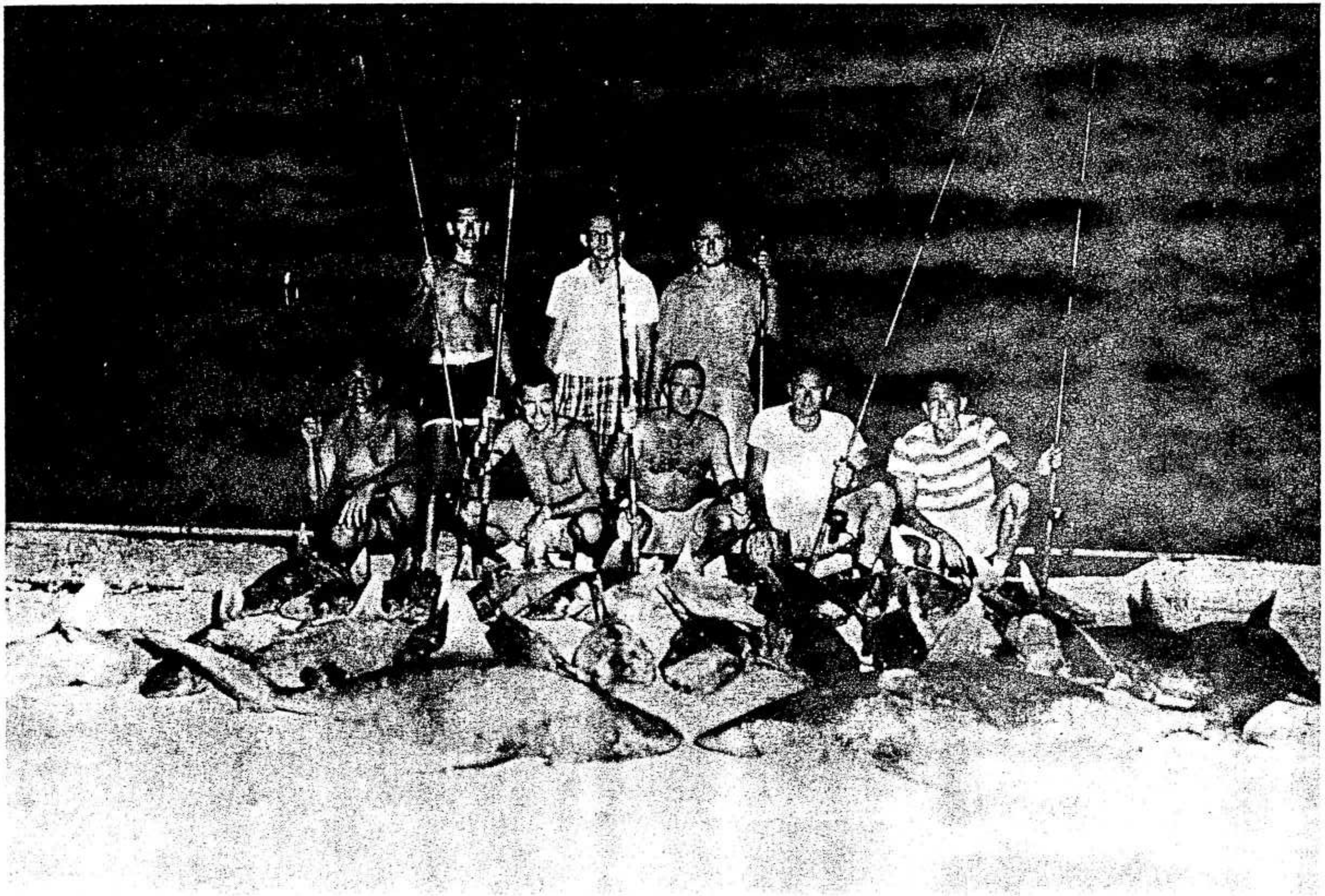
Major Troy G. Alcorn, commander of the 24th Support Squadron, poses with Pete, one of the two Siamese cats who served as official Johnston Island mascots
(Photo courtesy of Colonel Troy Alcorn)



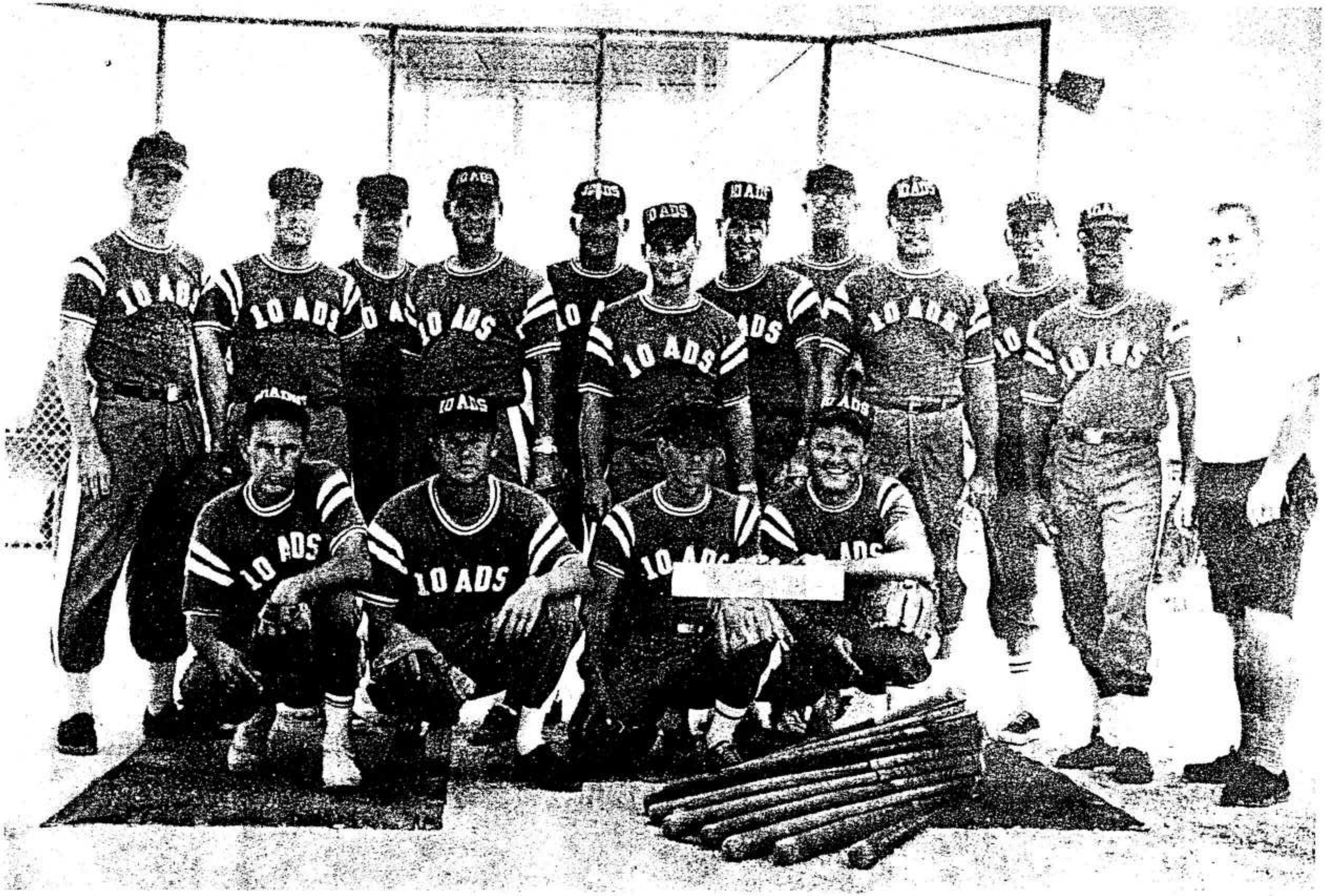
Lieutenant Colonel Robert Ebey, 10 ADS (center) and Major Troy G. Alcorn, 24th Support Squadron (right) escort an unidentified VIP to the Johnston Island launch complex, circa November, 1966
(Photo courtesy of Colonel Troy Alcorn)



Personnel of the 24th Support Squadron pose before the
Liquid Nitrogen Storage tank on Johnston Island
(Photo courtesy of Colonel Troy Alcorn)



Program 437 anglers pose with their
catch of sharks on Johnston Island
(Photo courtesy of Colonel Troy Alcorn)



The "Rim Rats" of the 10 ADS, one of
Johnston Island's many softball teams
(Photo courtesy of Colonel Troy Alcorn)

APPENDIX II

(Unclassified)

Summary of Thor Launches from Johnston Island, 1962-1975

Launch No.	Serial No.	Launch Emplacement	Crew	Zulu Date	Project	Remarks
1	177/58-2288	1	DACO	02 May 62	Fishbowl	Tigerfish
2	199/58-2310	1	DACO	04 Jun 62	Fishbowl	Bluegill
3	193/58-2304	1	DACO	20 Jun 62	Fishbowl	Starfish *
4	195/58-2306	1	DACO	09 Jul 62	Fishbowl	Starfish (400 km)
5	180/58-2291	1	DACO	26 Jul 62	Fishbowl	Bluegill **
6	156/58-2267	2	DACO	16 Oct 62	Fishbowl	Bluegill ***
7	141/57-2649	1	DACO	26 Oct 62	Fishbowl	Bluegill (50 km)
8	226/59-2347	2	DACO	01 Nov 62	Fishbowl	Kingfish (95 km)
9	299/59-2420	1	DACO	14 Feb 64	437	Demo (Douglas crew)
10	209/58-2320	1	USAF	01 Mar 64	437	Demo Switchover
11	290/59-2411	2	USAF	21 Apr 64	437	Turnover CTL (Douglas crew with observer USAF crew)
12	227/59-2348	2	CC-A	28 May 64	437	CTL ****

(Appendix II continued)

14	155/58-2266	2	CC-B	05 Apr 65	437	CTL
15	188/58-2299	2	CC-B	07 Dec 65	437	437AP
16	242/59-2363	2	CC-B	18 Jan 66	437	437AP
17	196/58-2307	2	CC-C	12 Mar 66	437	437AP
18	289/59-2410	2	CC-A	02 Jul 66	437	437AP
19	168/58-2279	1	CC-A	31 Mar 67	437	CTL
20	205/58-2316	1	CC-C	14 May 68	437	CTL
21	252/59-2373	1	CC-B	20 Nov 68	437	CTL
22	152/58-2263	1	CC-A	27 Mar 70	437	S-Band Test
23	225/59-2346	2	CC-A	24 Apr 70	SDP	SDP
24	271/59-2392	2	CC-C	24 Sep 70	HAP	HAP
25	201/58-2312	2	USAF	19 Sep 75	BMDTTP	DG-5
26	274/59-2395	2	USAF	06 Nov 75	BMDTTP	DG-3

NOTE: All dates cited are Zulu and may differ from local time dates.

* Starfish was blown at T+60 seconds at 30,000 feet due to instability.

** Bluegill Prime burned on the launching pad due to main LOX valve malfunctioning and failing to fully open.

*** Bluegill Double Prime was blown at T+ seconds due to loss of actuator pot voltage.

**** 437 CTL was aborted due to flames burning VE actuator cable, causing short-circuit.

(Compiled by Technical Sergeant Eric G. Lemmon, 10 ADS, 19 March 1976)

APPENDIX III

(Unclassified)

Program 437/437AP Launches

Launch Date (Zulu)	Liftoff Time (Zulu)	Ballistic Flt Time Sec	Slant Range (km)	Alt (km)	Ground Range (km)	Azimuth (deg)	Code 9 Miss (m)	Payload Miss (m)	System Miss (m)
14 Feb 64	0747	369	1390	1000	820	295	2060	1466	1120
01 Mar 64	0640	649	1021	674	933	187	630	4084	4040
21 Apr 64	0615	597	1080	778	682	208	4780	2284	4580
28 May 64	0732	Failure	1291	932	833	269	210	Failure	
16 Nov 64	0657	538	1642	1148	1084	290	2392	2817	4806
05 Apr 65	0720	379	1515	826	1197	267	532	754	780
07 Dec 65	0228	328	1528	487	1398	153	502	2133	1670
18 Jan 66	1811	232	1019	459	1150	163	80	975	1035
12 Mar 66	0042	370	1661	472	1540	176	119	1278	1365
02 Jul 66	2053	457	1773	802	1493	150	317	2172	2313
31 Mar 67	0644	304	1442	484	1312	109	668	3183	2861
14 May 68	0705	297	1257	823	897	290	194	1707	1753
20 Nov 68	0708	381	1337	1158	600	298	213	293	475
27 Mar 70	0737	512	1672	1074	1189	338	228	2262	2256

APPENDIX IV

Historical Background of Johnston Island (U)

(U) Johnston Island, the site of Program 437's operational base, had a long history of obscurity by the time it became host to the US Air Force's nascent ASAT effort in the early 1960s. Characterized by one unhappy visitor as a place with "no other value than of location," and dismissed by another modern wayfarer as "little more than a line of surf and sand and coral," the island was actually part of an atoll comprised of four such spits of coral--Johnston, Sand, Akau, and Hikina islands--surrounded by a partially submerged reef. The atoll breaks the long swells of the Pacific at Latitude 16° 44′ 32" North and Longitude 169° 30′ 59" West, 725 miles west-southwest of Hawaii, and is technically classified as part of the Hawaiian Island chain. Johnston Island is the largest of the four, originally extending little more than a thousand yards and rising a scant forty-four feet above sea level. Typical of the treeless island atolls of the region, it lacks drinking water and boasts only a thin layer of topsoil to support the sparse growth of grass and herbs. Sand crabs, rats, and screaming legions of gulls and frigate birds were its only permanent residents for centuries before the first Europeans set foot upon it. The island enjoys an average temperature of 79.3, with the prevailing winds blowing from the east at 18-24 knots. Mean rainfall measures 26.11 inches per year.

(U) The atoll may have been first glimpsed by the crews of Spanish vessels sailing west from Mexico to the Philippines in the late 1500s, although no records have been found to substantiate such a sighting. The Polynesians certainly knew of the barren landfall long before then, and small groups of them had apparently been in transient residence upon it at various times.

(U) The first white men to chart the atoll's existence were probably Dutch mariners. In 1598 Captain Jacob Mahu sailed from Rotterdam with three ships to attempt a passage of the Pacific to Japan. One vessel was seized by the Portuguese in the Moluccas. By that time Mahu had died of disease, and command of the surviving vessels passed to a Captain Huydecoper. On 27 November 1599, these ships departed an island off the Chilean coast on a direct course for Japan. Several months later the Hope and Charity "fell in with certain islands in 16 degrees north, the inhabitants of which were man-eaters." Huydecoper shied away from contact with the cannibals, but eight sailors deserted from one of the ships in a pinnace and fled to the atoll, where they presumably fell victims to the inhabitants.

(U) Huydecoper sailed on for more northerly latitudes. The Charity disappeared after losing sight of the Hope in rough weather, but the latter vessel reached Japan in April 1690 and there chief pilot William Adams recorded the earlier island sighting in two letters that have survived to document the expedition's ordeal and possible discovery of the soon to be forgotten atoll.

(U) For the next 200 years the little coil of land remained unknown to all but the birds as European navigators probed other quadrants of the Pacific. On 2 September 1796, an American brig, the Sally, ran aground on a reef in the vicinity of Johnston Island, but the vessel's log failed to record the precise position of it once the crew extricated the Sally from the obstacle. In 1803 the Russian navigator Krusenstern was sailing near the island when his lookouts spied large flocks of birds in the distance, but he was unable to discern any nearby land mass. Krusenstern carefully noted the incident in his log, but by the next morning his ship was well to the north of the atoll, and it remained uncharted.

(U) Johnston Island was officially discovered on 14 December 1807, when Captain Charles Johnston of the British ship Cornwallis found "two very low islands having a dangerous reef to the eastward of them, and the whole not exceeding four miles in extent," at a position he computed at 16° 53′ North and 169° 31′ West. Dubbed both Johnston and Cornwallis Island in the wake of its discovery, the largest spit of land was subsequently recorded on Admiralty charts with its sisters in the Atoll chain and was thus granted a permanent cartographic identity. An American naval officer, Lieutenant J. M. Brooks of the Fenimore Cooper, later survey Johnston Island, but his notes on it aroused little public interest.

(U) Decades passed and only the occasional whaler or China-bound merchantman passed near the atoll. There was nothing there to invite landings, and the seabirds were left in immaculate isolation as they wheeled above the coral in search of fish or squabbled in the rookeries below their foraging gyres. It was the presence of large numbers of those birds and the dictates of both agriculture and military technology that conspired to make Johnston Island a place of coveted resources by mid-century.

(U) Several millennia of avian residency on the atoll had deposited tons of guano upon the coral foundations of the main island. The phosphates and ammonium compounds found in guano made it a rich fertilizer. The ammonium nitrate extracted from it also formed a key element in the manufacture of gunpowder and other explosives. American whaling vessels returned to port with accounts of scores of Pacific islands that boasted rich guano deposits; and in 1856 the United States Congress passed the Guano Act, which empowered American citizens to claim unoccupied islands in the name of their country for the purpose of mining guano. Forty-eight Pacific islands were eventually claimed under the auspices of the Guano Act. William Parker's San Francisco-based Pacific Guano Company was organized to dominate the trade, and in 1859 the firm's first substantial shipment of guano (fifty tons) was extracted from Johnston Island. Parker had competition from King Kamehameha IV of Hawaii, who also claimed possession of the atoll. The issue remained in dispute until 1898, when American annexation of Hawaii confirmed the company's claim to the guano beds.

(U) For most of the late 1800s and early 1990s the atoll lay neglected and forgotten again as the far richer possessions of Hawaii and the Philippines commanded American interest. At best the atoll seemed notable mainly as a hazard to navigation. Early on the morning of 2 December 1889, the whaler J. A. Howland ran aground on the reef, ripping a gaping hole in its hull. The ship began taking on water and a landing party put ashore on Johnston Island to prepare for off-loading of the vessel's supplies and the rest of the crew. Panic erupted as the men entered the lifeboats, and fighting followed among them. One seaman died in the melee, but the rest made it safely ashore. Two days later the vessel broke up and sank. On their third day ashore the castaways spotted a sail on the horizon and sent a boat off in a desperate attempt to intercept the passing ship. Through incredibly good luck, it overtook a sister whaler, the Abram Baker, which rescued the entire company.

(U) The next recorded visit to the atoll came in late December 1892 when the schooner Ebon and the whaler California encountered each other there. The two crews paused to celebrate Christmas on the island with singing and dancing on the beach and a feast assembled from the lagoon's rich supplies of fish.

(U) In the early 1920s both Johnston and nearby Sand Island were designated as bird sanctuaries by order of President Warren G. Harding, whose administration was characterized more by financial and ethical foul play than by any enduring contribution to ornithology. From that time onward the atoll hosted periodic visits of Smithsonian Institution staff members who compiled data on seabird migration habits.

(U) The rising imperial ambitions of Japan during the 1920s and '30s compelled the United States to reassess its position in the Pacific as the Japanese busily fortified their island mandates in the Marshalls and Marianas while casting covetous eyes eastward at the American possessions in the region. In 1934 Pan American Airways began its trans-Pacific air service from San Francisco to Hong Kong via Hawaii. Johnston Island was by-passed on the western leg of the run as the giant clippers flew a direct route from Honolulu to Midway and Wake Island for refueling stops. The US Navy exhibited greater interest in the advantages offered by the atoll's location. In October 1936, Admiral Ernest J. King dispatched four seaplane squadrons and their tenders from Pearl Harbor to reconnoiter the small islands to the west with an eye to adopting them as forward bases. King was particularly interested in Johnston Island, for he believed that it might be valuable as a site from which to extend the American warning perimeter for Pearl Harbor. An advance party dynamited a channel through the reef, which permitted the tenders to take anchorage while the aircraft operated from the lagoon.

(U) King's plans for an advanced scouting base network were largely neglected following his reassignment from the Pacific. Not until March 1941 did Rear Admiral P.N.L. Bellinger, Commander, Naval Base Air Defense Force, Pearl Harbor, continue the program of improvements on the island. Bellinger anticipated a possible strike against Pearl Harbor by Japanese aircraft carriers in the event of war, and saw Johnston Island as an ideal base for staging aerial patrols against such a threat.

(U) By October 1941, Admiral Husband E. Kimmel, Pacific Fleet Commander, had posted a small force of 162 US Marines to garrison the island. There were still no aircraft regularly based on the atoll to mount routine patrols. A shortage of suitable planes and conflicts with training schedules prevented a standing reconnaissance effort from being mounted from either Johnston Island or Midway. They could not have averted the disaster of 7 December 1941, even if scouting units had been based on those islands, for Admiral Nagumo's strike force approached its target from the distant north-northwest, well beyond the range of any aircraft that could have been based on Midway or Johnston Island.

(U) As it was, a patrol wing of PBY aircraft was dispatched to Johnston Island from Pear Harbor over the weekend of 29-30 November 1941. This action resulted in those valuable aircraft escaping destruction in the attack that came a week later. Ironically, it was an American aircraft flying from Johnston Island that almost compounded the damage inflicted upon American naval forces by Nagumo's stunning coup. On 8 December Lieutenant Commander G. T. Mundorff, commander of Patrol Squadron VP-21, was flying a belated scouting patrol back to Hawaii from the atoll when he spotted the ships of a task force that had sortied form Pearl Harbor prior to the Japanese attack of the preceding day. Mistakenly identifying it as part of Nagumo's fleet, Mundorff made bombing runs against a cruiser, destroyer, and the aircraft carrier Lexington, which was one of only three precious American carriers in the Pacific at that time. Fortunately all of Mundorff's bombs missed their targets, and the Lexington survived to help hold the enemy at bay in later critical battles. That night the understandably nervous marines on Johnston Island alerted the nearby task force to an imminent Japanese landing on the atoll, which proved to be a false alarm.

(U) On 15 December a Japanese submarine surfaced beyond the reef and shelled the garrison briskly for a few minutes before slipping out to sea again. A few days later the bombardment was repeated in like fashion with no casualties and little material damage inflicted upon the defenders. The leathernecks broadcasted another bogus invasion alarm on 31 December, but they had good reason to be nervous, for the natural reference point of the atoll attracted both friendly and enemy forces as they sparred and probed against each other in the opening months of 1942. On 9 January 1942 the Japanese submarine I-18 sighted the Lexington and her escorts as they cruised 300 miles northeast of the atoll. The submarine was unable to close the range for a torpedo attack, but the sighting did serve to draw prowling enemy submarines away from the near approaches to Pearl Harbor as they sought the American carrier.

(U) Two days later another submarine, the I-6, slipped a torpedo into the carrier Saratoga as it steamed 270 miles northeast of Johnston Island. The Japanese only damaged the vessel, which was withdrawn from action for repairs, but they mistakenly assumed that they had attacked and destroyed the Lexington. This fancied triumph buoyed the complacent sense of overconfidence which led the Japanese to disaster at Midway the following June.

(U) During January 1942 the garrison on Johnston Island was reinforced, for Admiral King, the new Chief of Naval Operations, had ordered Admiral Chester Nimitz, Kimmel's successor, to ensure that both

Midway and the atoll were secured against enemy seizure. Their concern over the outposts was well-founded, for on 14 January Admiral Isoroku Yamamoto, commander of Japan's Combined Fleet, ordered his staff to study the feasibility of seizing both islands for use as staging areas in an assault on Hawaii. Yamamoto's chief of staff responded with a plan calling for the Japanese to occupy both Midway and Johnston Island by the early summer as a prelude to an attack on Hawaii that was expected to force the remnants of the American fleet to stand and fight in a decisive battle that would end in its annihilation. "The Japanese considered these islands of such importance to the United States that inevitably the latter would either react to the attacks or attempt to recapture the islands," wrote Gordon Prange in Miracle at Midway. "This would bring about the long-sought decisive engagement between the Japanese and American fleets."

(U) The early Japanese plans envisioned a June 1942 descent upon Midway, followed by an August seizure of Johnston Island and an invasion of Hawaii. The carrier-based Doolittle bomber raid on Japan in April, followed by the Japanese repulse in the Battle of the Coral Sea in May dictated that they must seize the initiative again in the Central Pacific by unleashing Yamamoto's offensive. Thus Midway and Johnston Island promised to become the twin hinges upon which the course of the Pacific war would pivot.

(U) As the Japanese planning and preparations proceeded apace, Admiral Nimitz enjoyed the rare advantage of being able to read the enemy's communications due to his team of expert codebreakers, who identified Midway as the initial objective of the anticipated enemy offensive, despite a Washington-based naval intelligence estimate that selected Johnston Island as the objective. Luckily Nimitz opted to believe his own staff's estimate and disposed his forces to counter the thrust against Midway. Had Nimitz arrayed his carriers to await a strike at Johnston Island the results could have been disastrous for the United States. The Japanese landing force could have easily gained a lodgement on Midway, freeing Nagumo's carriers to swing east and south to interpose themselves between the American carriers and Pearl Harbor. Spruance and Fletcher, Nimitz's tactical commanders, would probably have been forced to fight against a poised and alerted enemy force enjoying a marked superiority in ships and aircraft. Johnston Island conceivably could have become the grave marker for the American Pacific Fleet in June 1942.

(U) Johnston Island played no direct role in the climatic action off Midway, and the atoll remained a temporary stop-over for patrol and transport aircraft until the spring of 1943, when small detachments of Lockheed PV-1 Ventura patrol bombers were posted there and at Midway to stage regular anti-submarine patrols. By then the war had passed on to center on such places as the Solomons, New Guinea, and the atolls of Tarawa and Makin in the distant Gilberts. Those who were stationed on Johnston Island had only the boredom and the sand crabs to battle. Although removed from the combat zone, Johnston Island, along with Noumea, Fiji, and Palmyra Island, was still regarded as a vital link in the sea line of communications to Australia.

(U) Following the war's end the atoll became just another oceanic backwater again. In July 1948 military jurisdiction over it was transferred to the Air Force, but that service found equally little use for the barren lumps of coral, and by the summer of 1956 plans were maturing to reduce the USAF presence on the island to caretaker status. That had changed by 1958, however, as the installation was readied for a new mission in support of a series of high-altitude nuclear weapons tests.

(U) By 1962 Joint Task Force Eight (JTF-8) a tri-service organization, had taken charge of the atoll and a major facilities upgrade was in progress to prepare it as the site headquarters for a new round of tests. Johnston Island was soon inundated with personnel and equipment as a massive construction effort changed the face of the atoll. Very soon the spit of land was better than doubled in size as coral dredging and crushing added new area to the island. What had originally been a 500-foot runway eventually spanned 10,000 feet. The population was measured in the hundreds as billets, offices, warehouses, and workshops joined the new launch control facilities that sprouted up among the coarse grass and sandy hummocks. All work revolved around the launching pads that were built on the island's western side to receive the Thor IRBMs that were used to loft the test weapons to altitudes of several hundred miles for detonation.

(U) By 1963 two nuclear test series had been successfully conducted from the island. In the HARDTACK series, two high-altitude bursts in the megaton range were set off in the vicinity of the atoll. The first device, code-named TEAK, was detonated on 1 August 1958 at 252,000 feet over the azure shield of the Pacific. The second, designated ORANGE, was exploded at 141,000 feet on 12 August. In the summer and fall of 1962 came the FISHBOWL test series, in which a megaton and three submegaton weapons were detonated on 9 July, 20 and 26 October, and on 1 November.

(U) These final tests proved interesting for a variety of reasons that bore on the later career of Program 437. "A number of failures in civilian electrical systems were reported to have been caused by the EMP from the high-altitude test explosions conducted in the Johnston Island area of the Pacific Ocean in 1962," stated a joint Department of Defense and Department of Energy report, The Effects of Nuclear Weapons, in 1977. In one instance the electro-magnetic pulse effect (EMP) from a 1962 test shot triggered the failure of "30 strings (series-connected loops) of street lights at various locations on the Hawaiian island of Oahu, at a distance of some 800 miles from ground zero . . . . It was also reported that 'hundreds' of burglar alarms in Honolulu began ringing and that many circuit breakers in power lines were opened." The future managers of Program 437 had good cause to recall these effects when they evaluated the practical utility of the Johnston Island-based weapon system.

GLOSSARY

(All Portions are Unclassified)

ABM	Antiballistic Missile
ABMDA	Army Ballistic Missile Defense Agency
ADC	Air Defense Command/Aerospace Defense Command
ADG	Aerospace Defense Group
ADO	Advanced Development Objective
ADS	Aerospace Defense Squadron
ADSO	Air Defense System Office
AERODS	Aerospace Defense Squadron (see ADS)
AFLC	Air Force Logistics Command
AFRTS	Armed Forces Radio and Television Service
AFSC	Air Force Systems Command
AP	Alternate Program
ARDC	Air Research and Development Command (see AFSC)
ARPA	Advanced Research Projects Agency
ASAT	Antisatellite
BMD	Ballistic Missile Division (of ARDC/AFSC)
BMDTTP	Ballistic Missile Defense Target Test Program
BMEWS	Ballistic Missile Early Warning System
CEL	Combat Evaluation Launch
CONAD	Continental Air Defense Command
CTL	Combat Training Launch
DASA	Defense Atomic Support Agency
DDR&E	Director Defense Research and Engineering
Defense III	Proposed ASAT system derived from Program 437, DSDD, and

	the Apollo Lunar Excursion Module.
DEW	Distant Early Warning
DMSP	Defense Meteorological Satellite Program
DNA	Defense Nuclear Agency
DOD	Department of Defense
DSDD	Defense Subsystem Development and Demonstration Program
DSP	Defense Support Program
FOBS	Fractional Orbit Bombardment System
GGS	Ground Guidance System
GOR	General Operational Requirement
HAP	High Altitude Program
ICBM	Intercontinental Ballistic Missile
INSSCC	Interim National Space Surveillance Control Center
IRBM	Intermediate Range Ballistic Missile
JCS	Joint Chiefs of Staff
LE	Launch Emplacement
LOX	Liquid Oxygen
LTV	Ling-Temco-Vought
LWIR	Long Wave Infrared
MECO	Main Engine Cut-off
MOCP	Missile Out of Commission--Parts
MST	Mountain Standard Time
NASA	National Aeronautics and Space Administration
NCOIC	Non-Commissioned Officer in Charge
NORAD	North American Air Defense Command/North American Aerospace Defense Command
NSC	National Security Council

OAO	Orbiting Astronomical Observatory
OSD	Office of the Secretary of Defense
PLV	Payload Vehicle
PMD	Program Management Directive
POM	Program Objectives Memoranda

Program 505 - Proposed ASAT system derived from the US Army's Nike-Zeus AFB.

Program 893 - Proposed use of modified Minuteman ICBMs as ASATs.

Program 922 - Proposed conventional ASAT system derived from Program 437.

PSAC	President's Science Advisory Committee
PTDP	Preliminary Technical Development Plan
R&D	Research and Development
RF	Radio Frequency
ROC	Required Operational Capability
SAC	Strategic Air Command
SAINT	Satellite Intercept and Inspection System
SATCON	Satellite Alert Condition
SEP	Spherical Error Probable
SPADATS	Space Detection and Tracking System
SPASUR	Space Surveillance System
SPO	System Program Office
SSD	Space Systems Division
TDY	Temporary Duty
USO	United Services Organization

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